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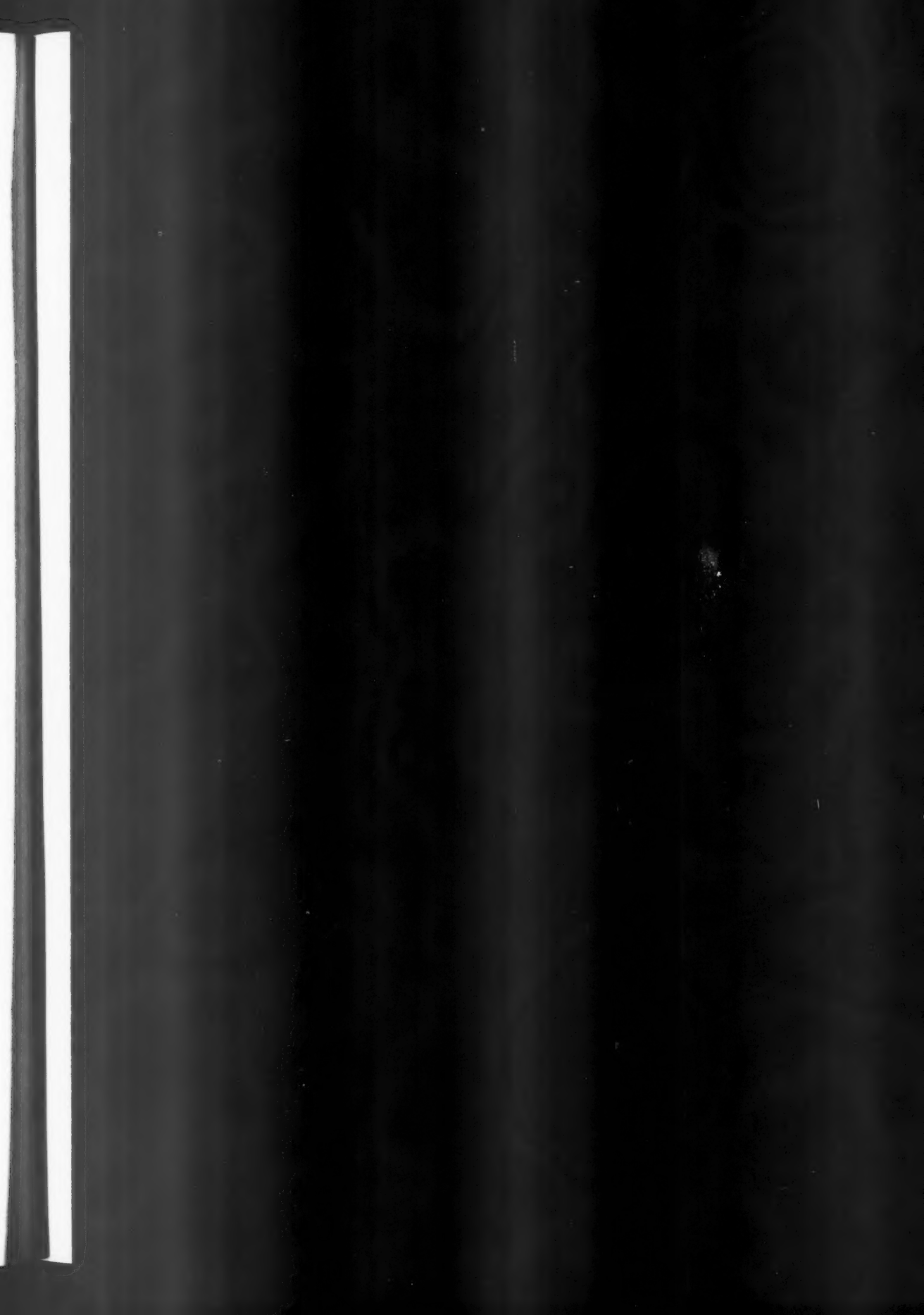

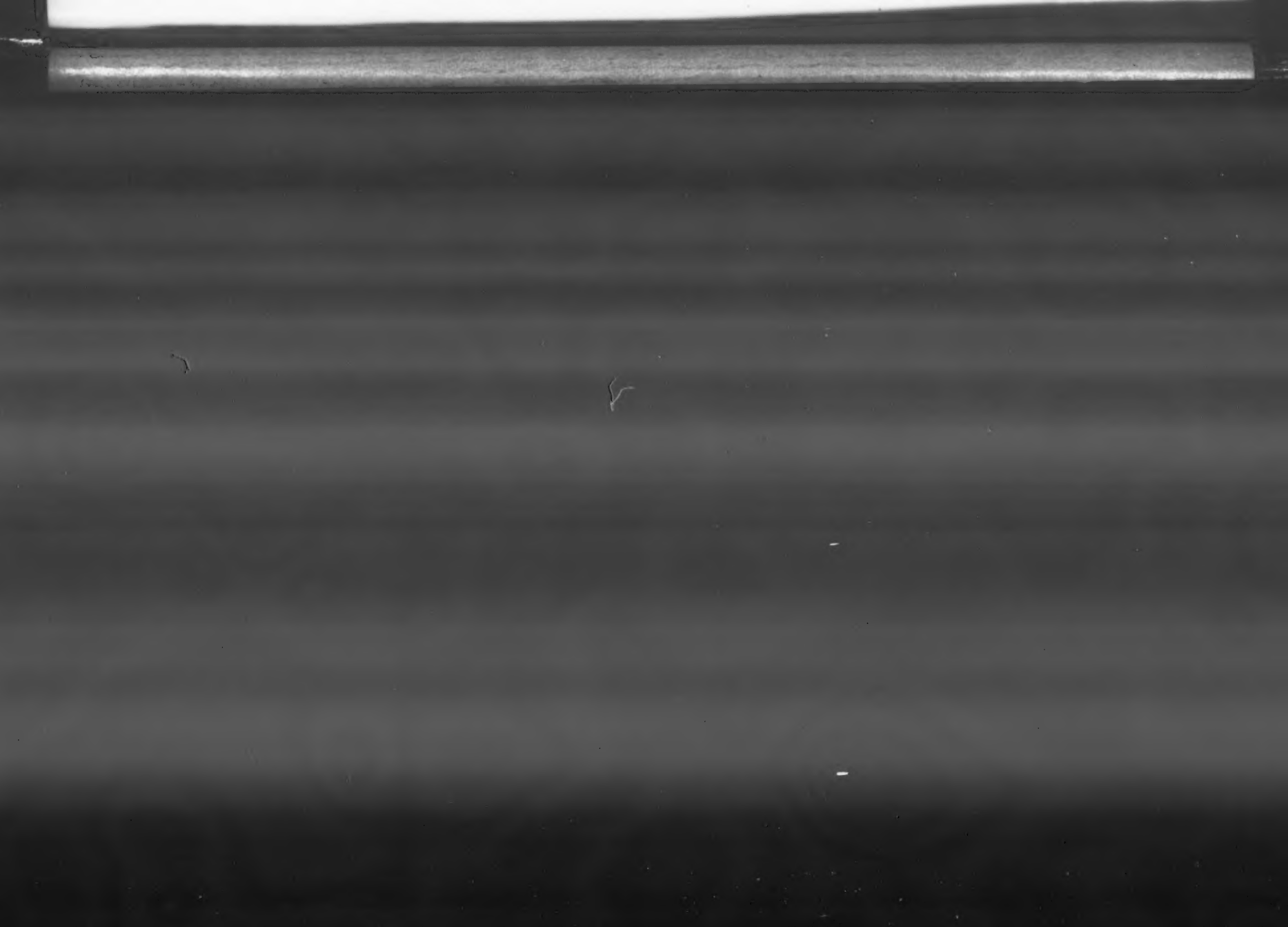

MUNICIPAL ENGINEERING

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PAPERS PRESENTED AT THE MILWAUKEE CONVENTION OF THE NATIONAL ASSOCIATION OF CEMENT USERS.

PRESIDENT'S ADDRESS.

By Richard L. Humphrey, Consulting Engineer, Philadelphia, Pa.

It is my pleasure to address you as president of the association which was launched so auspiciously at that memorable convention in Indianapolis barely one year ago. It would appear particularly fitting on the first anniversary of this association that such an address should dwell on the development in the uses of cement. It is an old but trite saying that "there is nothing new under the sun," and I am taking this opportunity, not for the purpose of relating anything new, but merely to refresh your memory on the facts concerning the increasing uses of cement. The use of cement is very old. That the ancient Phoenicians and Egyptians understood the use of mortar is attested by the ruins of their massive masonry structures, the joints of which contained hardened mortar. It is stated by some writers that there is evidence of the use of mortar as far back as 4350 B. C. That the Romans made use of mortar at an early date is shown by the writings of Vitruvius, but we also learn from Pliny that these mortars were bad, for he tells us that "the cause which makes so many houses fall in Rome resides in the bad quality of the cement." From the downfall of the Roman Empire to the beginning of the eighteenth century the manufacture of cement seems to have been discontinued. Such cement, mortars and concretes as survived the ravages of the elements had become so hard that Roman cement acquired a reputation for quality which led the earlier experimenters of the eighteenth century to seek to recover this lost Roman art.

You are all doubtless familiar with the impetus the use of cement received through the experiments of John Smeaton in 1756, by the patent issued to Parker for the manufacturing of Roman cement in 1796, and by the experiments of Vicat and Collet-Descotils. Portland cement proper, however, did not receive its birth until 1824, when John Aspdin received his patent for manufacturing Portland cement, which he so named from its fancied resemblance to the building stone obtained from the Isle of Portland. From this date to 1850 very little progress was made in England. In other parts of Europe the development from 1855 was steady and continuous.

Natural cement was first manufactured in the country by Canvas White in 1818, and reached its maximum development in 1899.

It was not until 1872 that American Portland cement was manufactured by David O. Saylor, in Pennsylvania, in an experimental way. Three years later he was able to manufacture it successfully, and our first Portland cement was exhibited at the Centennial Exposition in 1876. The slow development of this industry was due largely to strong prejudice against the American Portland cement. The successful introduction of the rotary kiln in 1889-1890 marks the beginning of the rapid and remarkable development both in the production and consumption of American Portland cement. This is very clearly shown diagramatically. The contrast between the capacity of the first cement plant in this country and the modern Portland cement plants, having capacities of from 2,000 to 10,000 barrels

per diem, is just as great as the contrast between a yearly production of 335,000 barrels in 1890 to the nearly 27,000,000 barrels produced in 1904; and this development is now not confined to one or two points, but is spreading over the entire country.

While it is true that the use of cement in mortars for binding together masses of masonry, or in concrete, is very old, its use in the construction of arches, beams, columns and other structural parts is quite recent, and the remarkable development in the diverse uses to which it is put is all within the recollection of the present generation. These uses may be grouped as follows:

(1) In mortars, binding together large masses of stone or brick, etc., or for casting various forms — artificial stone, hollow block, brick, etc.

(2) As concrete in mass or under conditions where it is only subjected to compressive stresses; and

(3) As reinforced concrete where it is subjected to both tensile and compressive stresses.

For the first part of Group 1 it will be sufficient to observe that cement mortar is rapidly replacing lime and natural cement mortar.

It is worthy of record that on November 17, 1850, Joseph Gibbs obtained a British patent for casting solid walls of concrete in wooden forms, while on March 6, 1866, C. S. Hutchinson obtained a United States patent for hollow block and brick walls making continuous vertical air spaces, and on April 14, 1874, T. B. Rhodes also obtained a United States patent for hollow block and shingles. Patents were granted to C. W. Stevens for the manufacture of artificial stone in 1897, and to J. C. McClenahan in 1902.

The manufacture of artificial stone is now making progress and is successfully competing with cut-stone work of ornamental character, both in price and quality. In the manufacture of hollow block there has been very unusual development. Indeed, it has been so rapid and has appeared so attractive as a field for investment that inexperienced persons with insufficient capital and experience in this new business have rushed into the field, and the result has been the manufacture of poor material, which has not been acceptable to the builder, and this has contributed no little toward retarding the development. This class of building material has come to stay, and it will only be a question of time when matters will so adjust themselves that first-class material will be uniformly produced, and it will form a very desirable substitute for brick and stone, and in cheapness will eventually compete with wood.

The use of cement has been quite general for many years for sidewalk work, and pavements of this character are by all odds the best attainable. As concrete, however, is deficient in edge strength, it has been found necessary to apply steel protection to the edges, and there are excellent patented types of steel-bound curbs on the market. The use of concrete for piers, abutments and arch bridges without steel reinforcement is too general to need comment. Additional information, however, is greatly needed as to the proper means of providing for the expansion and contraction of concrete in large masses.

The first concrete arch bridge was built in this country in 1870, in Prospect Park, Brooklyn, and to the Erie railroad is given the credit of having lined the first tunnel with concrete — namely, that at Bergen, N. J., in 1874. A notable development in the use of concrete for bridges is illustrated in the construction of the bridge over Rock creek in Washington. The voussoirs for the arches of this bridge are molded separately, are then air-hammered, dressed and then hoisted into position, these blocks being handled similar to stone, holes being cut for dogs. The spaces between these rings and the spandrel walls are cast in place with concrete. No sand is used in the concrete for the arch ring, the crushed-rock screenings being substituted, and the bluish tint of the rock produces a marked contrast to the color of the concrete used in the spandrel walls, in which a yellowish sand is used. Concrete sewers and retaining walls, harbor bulkheads of plain concrete are also so extensively used that they are no longer a matter of special interest.

Reinforced concrete, however, is of more recent development. This use of concrete was probably known prior to 1855, for at the Paris Exposition in that year a system of reinforced concrete was exhibited by Lambot. In 1861 Coignet proposed a method of reinforced concrete construction. The first application of metal reinforcement for concrete by Monier was in 1867 in the construction of some very large flower pots. In 1868 Monier obtained his first patent for reinforced concrete, but it was not generally used until after 1880, although in 1879 he again exhibited at the Antwerp Exposition a system of reinforced concrete construction.

The first reinforced concrete construction in this country is credited to W. E. Ward in 1875, who erected in New York

city a house having the floors and columns of reinforced concrete. It should be noted that in 1876 Thaddeus Hyatt, an American engineer, published his experiments on reinforced concrete in the Laboratory of Kirkaldy, London, England. The experimental work of Hyatt extended from 1870 to 1880. The first Ransome patent was taken out in 1882, and it was applied in the construction of his first building in 1884. Between 1891 and 1894 Moeller in Germany, Muensch in Hungary and Melan in Austria were pioneers in the development of reinforced concrcete construction in Europe. The use of reinforced concrete on a large scale began under the system of Moeller in Germany in 1893 and Rabits in 1898. Hennebique had built reinforced concrete floors as early as 1879. It was not, however, until 1892 that he obtained a patent for his system of reinforced concrete construction.

The last ten years have seen a very remarkable development in reinforced concrete construction. At first reinforced concrete construction was used largely in the construction of bridges, the first of which was built in this country over the Pennypacker creek in Philadelphia in 1893 and for which I had the honor of inspecting the cement and other materials, as well as the construction of this bridge. From this beginning the use of reinforced concrete has developed rapidly, and we find it is used in almost every conceivable form of construction. Large sewers, water pipes, reservoirs, coal bunkers, pneumatic dams, chimneys, grain-storage bins, bridges and buildings being some of the many applications.

Experiments have been made in the Reclamation Service for its application in large reinforced concrete pipes of five feet diameter and capable of standing upward of seventy pounds in pressure, while one of the most novel and recent applications of reinforced concrete is for reinforced crib work, under the Fraser system, which, it is stated, costs a little more than timber cribbing, and which has been used extensively in Canada. Chimneys 350 feet in height have also been successfully constructed of reinforced concrete. The Harvard Stadium, the baseball stand in Cincinnati and the stadium of the Washington University at St. Louis are all novel examples of the use of reinforced concrete, while concrete ties reinforced in various ways have been in use for some time, though they have not been satisfactory. The cost of maintenance, however, has been found to be reduced to a nominal sum and the alignment has been found to be very easily maintained, which greatly offsets the first cost. The rigidity of the roadbed, however, has been a prime objection, and an effort is now being made to introduce an elastic cushion in the tie in order to overcome this objection.

It is in the erection of office buildings of considerable height that the development has been most remarkable. Buildings of eighteen stories' height are being erected in which the skeleton is of reinforced concrete. Considering that the use of steel for reinforcing concrete beams was not suggested until 1882, a development of this character is certainly remarkable, and we have reason to pause and consider whether such extreme development is wise.

While visiting a large city recently I had occasion to inspect a building several stories in height in which cinder concrete was being used in the structural parts. The contractor, in reply to my surprised query, stated that the building was still standing. This was indeed true, but what was the margin of safety in this structure? As this concrete had a compressive strength of about half of what could be expected from a fairly good concrete, the factor of safety had therefore been cut in half. In further explanation he stated that in order to compete with other contractors he was obliged to use the same materials which they did. The use of inferior materials should not be permitted in reinforced concrete construction, and the present situation in the development of concrete and reinforced concrete is one that should be faced squarely. That it is possible to erect a sixteen-story building of reinforced concrete has been demonstrated, but we should have a better knowledge of the properties of this material before such a practice becomes general. Ten years' or less experience with a material in which chemical changes are constantly going on, and which may be affected by the changes produced by expansion and contraction, is hardly sufficient to enable us to obtain a thorough knowledge of its properties.

The American Society of Civil Engineers recognized the vital importance of this subject and recently appointed a committee on concrete and reinforced concrete, with instructions to affiliate in its work with similar committees of the American Society for Testing Materials, the American Railway Engineering and Maintenance of Way Association and the Association of American Portland Cement Manufacturers. After over a year's work they have found that

(1) Thoroughly reliable data upon which they can formulate a report as to the rules and formula to be used in

the design of reinforced concrete structures do not exist.

(2) That the results of the tests made in laboratories of the various technological institutions are not sufficiently comparable nor correlated for the purpose of obtaining these data; and

(3) That in order to secure the requisite data it will be necessary to conduct a complete series of tests in one laboratory where the conditions are as uniform as it is practical to obtain them and where the personal equation is reduced to the minimum.

This requires considerable money. Fortunately the small appropriation made to the United States Geological Survey for the investigation of structural materials has been applied to this work, and the investigations have been inaugurated under the direction of an advisory board on fuels and structural materials by the United States Geological Survey in cooperation with the joint committee on concrete and reinforced concrete of the American Society of Civil Engineers and affiliated societies. In the absence of reliable data and under the conditions in the present state of the art the courage to erect eighteen-story buildings must command our admiration. I do not wish to be deemed pessimistic or overly conservative, for my belief in the future of concrete and reinforced concrete is absolutely unshaken, and I feel that the use of cement will so expand during the next few years that it will go beyond the limits of its most ardent advocate, but I do wish to point out the dangers which will result from its indiscriminate and foolhardy use and to protest against the people who rush in and guarantee ridiculous things in concrete construction.

Concrete fills an important and growing field, but it has its weaknesses and its limitations, and this should be pointed out and recognized squarely by its advocates. It is evident to any one who delves into the subject that reliable data for use in design of concrete structures are very much needed, and the work the joint committee on concrete and reinforced concrete is doing in co-operation with the United States Geological Survey should receive the encouragement and support of each one present, and I would ask you to use every effort in urging upon your congressman the vital importance of securing an appropriation for the continuance and completion of this very important work, for the attainment of reliable and uniform data for use in the design of structures in concrete and reinforced concrete will insure a more rapid, safe and successful development in the use of cement.

STEEL FOR REINFORCEMENT.

By A. L. Johnson, M. Am. Soc. C. E., St. Louis, Mo.

The history of the origin of reinforced concrete has been published so often that the speaker will not enter into this part of the subject further than to say that he thinks too little credit has been given to Thaddeus Hyatt, an American, for the work he did in the year 1876 and 1877 in England. He made numerous tests of reinforced concrete beams at Kirkaldy's laboratory, reinforced with bars of different patterns and arrangements, developing at this early date the advantages of stirrups, of having them connected to the bar, of bending bars up at the ends for shearing provision in short beams, and in a general way the advantage of a mechanical bond, though his investigations here did not enable him to learn the criteria for differentiating the efficient from the non-efficient.

Up to the time of Hyatt very little work in reinforced concrete had been done abroad, other than in tanks, vases, pots, etc., in which the section was entirely in tension, and in which, therefore, there was little tendency for different movement on the part of the metal and the concrete, such as occurs in reinforced concrete beams. Neither had there been anything of consequence in the United States, about the only instance now known being a building constructed entirely of reinforced concrete by Ward in 1875, in the State of New York.

Ransome made some experiments in San Francisco on reinforced concrete beams, and on September 16, 1884, received a United States patent on a floor construction of concrete reinforced with square bars twisted, claiming as advantages over plain material an increase in tensile strength and a more secure bond. Later, he applied for and secured a patent on a triangular twisted bar, the contention for patentability being that this bar would not split the concrete ribs in which the bar was embedded, owing to the deeper cupping that would be obtained in the triangular type. Mr. Ransome's theory of the splitting action noticed is

explained in the patent as follows:

Assuming a Tee beam, or ribbed floor construction, in which the rib is reinforced with a steel bar, when the floor is loaded, the bar being bent up at the ends, it is as if the rib were held up by the bar, or sitting on the bar. If the floor is loaded to, say, 400 pounds per square foot, and the ribs are, say, 3 feet apart, then there is a vertical load of 1,200 pounds on top of the rib for each foot of length. Hence, the rib acts as a column, being supported on the bar at the bottom. As the bar is narrow, there is a tendency for the concrete to flow each side of the bar, or, in other words, there is a movement of the concrete above the bar, cross-wise of same. In a plain bar there would be no obstruction to the movement. In the square twisted bar there was not, according to Mr. Ransome, sufficient obstruction to the movement, as the cupping was not sufficiently deep. Hence the superiority of the triangular type.

The above theory was, of course, fallacious, and the type never came into commercial use. The vertical load on the rib for any given length is carried by vertical shear in the concrete, and the rib is not acting as a column at all. If it were, in the case mentioned where the rib carried 1,200 pounds per lineal foot, supposing the rib to be 4 inches, this would only give a compressive stress in the rib of 25 pounds per square inch, and would be too small to be noticeable even if many times this amount.

The ribs do not act as columns, but as beams, lengthening on the bottom and shortening on top, and it is the movement of the concrete lengthwise of the bar which the bar must be calculated to resist, and it is in this resistance that it begins to help carry the load and become an integral part of the structure. To offer reliable and satisfactory resistance to this movement of the surrounding concrete along the bar, it is necessary for the bar to have on its surface projections, or depressions, the sides of which are nearly at right angles to the direction of the movement, which is to say, to the bar itself. It is not necessary that the sides of these ribs or depressions should be exactly at right angles to the bar to develop this efficiency, however, it being possible to vary therefrom an amount equal to the angle of friction between the concrete and the metal, which, on the average, will be between 30 and 45 degrees. But if the surfaces against which the concrete presses are nearly parallel to the direction of the movement, we have the same action as when an ax is forced into a block of wood, a very heavy splitting component resulting, which may be many times as great as the direct force itself, similar to the action of a toggle joint.

Of course, this splitting action is of little effect until after the so-called adhesion of the concrete to the surface of the metal has been overcome. This adhesion is not really adhesion at all in the sense that two pieces of wood may be made to adhere to each other by means of glue. The appellation has been given to the resistance of a bar against withdrawal from a block of concrete. As a matter of fact, this resistance is made up of two parts, friction and a mechanical bond caused by the entering of the cement particles into microscopical pores on the surface of the metal, which particles have to be sheared off in withdrawing the bar. For short depths of embedment these two forces amount to about 500 pounds per square inch of bar surface for bars of ordinary mill surface and for good concrete, where perfect union exists between the cement and the metal. Of this, friction contributes about 25 pounds per square inch, the remaining 475 being due to the mechanical bond. There is therefore no reason in advocates of plain bar reinforcement decrying mechanical bond, inasmuch as the plain bar has really no value not contributed by this same quality. The bond, it is true, is of a microscopical nature, but nevertheless its value is considerable, and if it would remain intact we could design and execute reliable concrete structures with plain bar reinforcement.

There are a number of things, however, tending to impair a bond of this nature, amongst which we may mention the following:

1. Shocks and vibrations continued through years of service are liable to injure, if not wholly destroy, the bond, and have done it in cases under the speaker's own personal observation.

2. Where the concrete is continually wet, the adhesion will be cut down from 50 to 60 per cent. in less than one year, as indicated by the experiments of Breuillie.

3. The development of the working stress in the metal slightly stretches same, and the cross section is therefore slightly reduced. Suppose the metal has a working stress of 15,000 pounds per square inch, then the proportionate elongation is .0005, and the decrease in the diameter is, with practical exactness, one-half this, or .00025, a quantity which, though small, could be readily measured by an ordinary micrometer, and certainly is far from microscopical.

The advisability of reinforcing bar with a more positive grip on the concrete

than that afforded by the roughness of the mill surface of a plain bar, which is, of course, very slight, is not merely due to the necessity of maintaining continuously the strength of the beam, but also to the necessity of keeping the bars from being exposed to the atmosphere.

We know, now, that in a reinforced concrete beam cracks begin to form in the concrete on the tension side, at an elongation which gives a stress of from 12,000 to 15,000 pounds per square inch in the bars, which is at just about, or even a little below, the working stress usually employed. If plain bars are used these cracks will be far apart and correspondingly large, while if a bar is used having a positive grip on the concrete for every inch of bar, there can be no accumulation of cracking tendency for a considerable length, but there will be a great many cracks, mostly invisible to the naked eye, until the metal has passed its elastic limit. Such cracks will not be injurious, while the cracks that form with the plain bars might. They amounted to considerable in the tests made about five years ago by M. Considere, as a result of which he reported the wonderful stretchability of reinforced concrete that misled us all for some time. In these tests he bent the beam several hundred times, so that the tension fiber had been stretched from 15 to 20 times as much as plain concrete would stand, then cut a piece 8 inches long out of the middle surrounding the ¼-inch round rod that he used for the reinforcement, and then with great pains and labor cut the rod out of this 8-inch piece of rectangular section, leaving a hole through same from end to end. Now this concrete had been stretched, according to M. Considere, many times as much as plain concrete would endure, but instead of falling apart when the rod was finally gotten out, it was perfectly intact, and he put it on supports, loading it in the middle, and obtained as much carrying capacity as he could have secured with the same kind of concrete which had never been subjected to such severe usage. This seems like proof positive of M. Considere's conclusion. But it developed later that he had taken this 8-inch specimen from between two cracks of considerable size, and that while the rod had undoubtedly stretched as much as assumed the surrounding concrete had not, the end sections slipping back and relieving the concrete. In other words, there was a slip between the rod and the concrete. If the rod he used had been a rod of mechanical bond, giving a good positive grip for every inch of its strength, he would not have had this slip between the rod and concrete.

The distance between cracks on the bottom of a reinforced concrete beam subject to uniform bending moment, may be discussed as follows:

Let d=spacing of bars in inches.
e=distance from center of bar to surface in inches.
ft=tensile strength of the concrete in pounds per square inch.
s=bonding value of bar in pounds per square inch of surface.
l=spacing of cracks in inches.

The cracks will come at such distance apart that the bond of the bar for the distance equals the tensile strength of the concrete immediately around the bar, having in this respect a close analogy to the distance apart of the shrinkage cracks in a retaining wall.

Then we have for a square bar,

$$def_t = 4sl$$

$$\text{or } l = \frac{def_t}{4s}$$

On plain bars with real smooth surface s has been found less than 100 pounds per square inch, though, as before stated, for the ordinary rolling mill surface, with careful embedment, it has a value originally of about 500 pounds per square inch. Assuming for allowance for ordinary working conditions, and for reduction due to shrinkage of bar section, an average value of 250 pounds where there is no vibration of consequence, and where the concrete is not wet, as it would generally be in open-air work, we have,

$$l = \frac{def_t}{1000}$$

For a mechanical bond bar, such as the corrugated bar, for example, this value will be in the neighborhood of 750 pounds per square inch, a value also which will be practically permanent, and for this,

$$l = \frac{def_t}{3000}$$

That is to say, the latter type would give cracks of only one-third the size that would be the case in the beam reinforced with plain bars, even under the best average conditions. In the case of open-air structures, subject to vibration for some years, the disproportion might be very much greater than this.

The speaker has often been asked the question, Why is it necessary to use bars of mechanical bond, when abroad, where their experience is much greater than ours, they use only plain material? The question is a very proper one, and requires an explanation. As before stated, it is only in beam work that the necessity for absolute bond between the concrete and

the metal exists, and in this line of work the beginning was made in this country in 1882. These structures were intended for floors, and to carry people and loads of different kinds, and not vases, flower pots, etc., of which the foreign work up to that time mainly consisted, all of which was reinforced with plain material. For floors and beam work in general plain bars did not seem a rational material to use, just as a common sense proposition; and the speaker doubts very much whether, if the construction of such work had been presented first abroad, the foreign engineers would have considered the use of plain bars, either. The natural development would have been to have used a form of mechanical bond first, and later, if investigations showed it feasible, come to the simpler and cheaper form of plain material.

A year ago last May the Prussian government specifications on reinforced concrete were issued, and they cut down the safe allowable working stress in adhesion to about 30 pounds per square inch, recommending at the same time mechanical bond whenever possible. The above restriction on the working stress in adhesion made it very expensive, and in many cases impossible to use plain material, so that the recommendation in favor of mechanical bond was scarcely necessary. In France, too, much greater care is now taken, the bars being bent up and down and around about in the effort to obtain a better anchorage, as well as to provide for shearing stresses.

In specifying bars for reinforcement, there are a few fundamental principles that should be observed. In the matter of elastic limit, the general proposition is that the elastic limit should be as high as is consistent with the ductility required by the case in hand, up to, say, 60,000 pounds per square inch. There is no object in having a higher elastic limit than this unless the modulus, too, could be raised, which is, at the present time, not feasible. Preference should be given to more bars of small section, rather than to few bars of large section, as it is desirable to have the metal well distributed through the stretching concrete area. The bars should not be painted. A slight film of rust is no injury at all, and will totally disappear after embedment. But if the bars have been exposed long enough for scale to form, this must be removed before use.

In designing, the factor of safety should, generally speaking, be four at least, certainly never less than three, which is based upon the elastic limit. That is to say, the working stress for the actual loads should be only one-fourth of the elastic limit. Many of the municipal building laws are seriously in error in that particular. This will require about three-quarters of 1 per cent. reinforcement for material having an elastic limit of 60,000 pounds per square inch, and 1 3-10 for metal having an elastic limit of from 30,000 to 35,000 pounds per square inch. These are the percentages required to develop the full strength of the section in bending. Short beams, having a ratio of height to span of more than one-twelfth, will have to have some of the bars turned up at the ends, where they are not required for moment, to take care of the shear. This bending is readily done on the job cold, unless the bars are exceptionally heavy in section.

CEMENT AND BUILDING CONSTRUCTION.

By C. A. P. Turner, M. Am. Soc. C. E., Minneapolis, Minn.

The members of the Cement Users' Association may with reason congratulate the American Portland cement manufacturers on the uniformity and reliability of their product. They have reached this degree of perfection in their cement only by careful study of methods and materials used, combined with systematic tests of the resulting product. The cement user may well profit by their example and study his methods in the use of cement if he is to produce results at all in keeping with the high grade and possibilities of the material he is using.

In foundation work, Portland concrete is largely replacing footing stones, giving a continuous monolithic construction, which, where the ground is soft, may be readily and cheaply reinforced with rods. Where the conditions are still more unfavorable and piling is used, a concrete cap reinforced has evident advantages over timber.

In placing the material it may not be amiss to suggest to those who expect results without attention and care on their part, that failure to properly mix the materials and depositing the concrete haphazard without consolidating it by tamping and puddling, or allowing mud and sand to flow around the several shovelfuls or barrelfuls deposited, will quite likely result in a footing of little more value than one the writer was forced to

remove from under a reinforced column carrying five stories. The contractor, who appeared careless to a reckless extent and thoroughly incompetent, rather than dishonest, stoutly asserted that the mixture was according to specifications and the pier according to plans. When clamps were put on the column and the footing removed, bad cement was the excuse. The idea that bad workmanship and the lack of cement had anything to do with it, seems not to have occured to him, although in removing the material a pick could be driven into it half the length of the blade and streaks of sand and clay unmixed with cement could be found in nearly every sample.

In exterior walls of concrete many depend for finish on a plaster coat after the work has hardened up. Wetting the walls thoroughly sometimes enables a sound coat to be applied, though often there is scaling and chipping when the work dries too rapidly. Removal of the forms early and rubbing down all inequalities before the work has hardened and as soon as it has sufficiently set to stand without forms will obviate this difficulty.

As a cheaper form of construction, cement brick and concrete blocks are coming into use. The general prejudice against this type of construction amongst architects can readily be accounted for. Too many block manufacturers believe in mixing their concrete 1 cement to 7 or 8 gravel and selling it for a 1-to-3 mixture. Then, again, through the unfortunate fad of imitating rock-faced stone, our concrete-block friends must be credited with the production of the most monotonous building material ever placed on the market.

Too little attention seems to be given to artistic effects that should readily be obtained in the manufacture of blocks at a comparatively insignificant increase in cost. The practice of facing with a selected material, such as fine white sand or crushed marble or granite with a rich mixture of cement, seems to have been followed only to a very limited extent, while as a matter of fact it is practical and comparatively inexpensive. By casting the faces downward the facing may be made thin and quite dry and the backing wet enough so that it will supply the necessary moisture to properly crystalize and harden the drier facing. The object of making the facing dry is, of course, so that it can be removed from the mold without sticking to it and destroying the finished surface, which would be the result in using a wet or moist mixture. By a dry mixture the writer does not refer to one which is mixed without water, but to one that is not sufficiently wet or, rather, moist to stick to the plates of the machine when tamped.

The writer's observation of the manufacture of cement brick is that by the use of a dry facing of fine white sand, mixed in the proportion of 1 cement to 2 sand, averaging a quarter of an inch thick, backed by a mixture of 1 cement to 4 coarse, sharp sand, made wet enough to stick together when a sample is placed between the thumb and finger, very satisfactory results were obtained and with no trouble in curing. On the other hand, such a mixture would force the workmen to wipe the division plates of the machine every second or third batch, and they are too much inclined to save themselves this trouble by using a drier mixture which can be cured, if at all, only with difficulty and repeated wetting. The difference in the amount of moisture in the two cases is slight, but the difference in the product at the end of twelve hours is very marked. At the end of that period the brick made with a moist backing would set so that the corner would have an edge sharp enough to cut the skin of the finger if rubbed along it, and if the brick were thrown against a hard block it would break into fragments like a burned brick. On the other hand, in one made with the dry backing the corner could be readily sanded out, and if the brick were treated as the other there would be nothing but sand left of it.

It may be imagined by some that there would be a plane of cleavage between the rich facing and the leaner backing, but in no case has the writer been able to break the facing away from the backing, cleavage occurring in all cases either on one side or the other of this plane.

The cement brick the writer has had experience with, unless of considerable age, do not stand shipment well. Better methods of curing will undoubtedly remedy this and seem equally applicable to the block business. A warm, damp atmosphere is most conducive to the hardening of concrete, and it would seem that a curing chamber into which the blocks and bricks could be placed and subjected to an atmosphere of exhaust steam would be an ideal arrangement. To realize properly the possibilities in this line of work evidently requires honest and thorough work, combined with a careful study of methods and results, and when this is fully realized by those engaged in this line we may expect the architect will be ready to favor the material which you have demonstrated to be strictly high grade. This demonstration, however, must come from the manufacturer, as he cannot consistently expect the architect to specify something which might

be satisfactory if the work was well executed, with the chances against this being realized.

In interior construction the advantage of concrete, properly reinforced, over timber or steel lies in its permanence, the perfect protection of the steel against corrosion or destruction by fire and, last but by no means least to the peace of mind of the builder, the avoidance of complicated shop details and the opportunity for the annoying little errors and endless delays incident to structural iron work.

In treating the subject from the popular standpoint the writer would say a few words as to the reliability of the construction as compared with steel or timber. Ignorant abuse will render dangerous the best material the engineer uses—for example, some months ago the writer was called upon to inspect some coupler pockets forged out of 1¼x4-inch bars. They were worthless, the writer was told, and, going to the pile and selecting four, they were placed on the ground and struck a few sharp blows with the sledge. A single blow fractured 10 square inches of metal in two cases. In normal condition this area would carry 600,000 pounds in tension. Taking the shank to a steam hammer, the center was bent flat on itself without fracture, proving that the smith had burned the steel in forging until it was worthless at the bend. Similar inexcusable ignorance in working concrete will likewise result in inferior work, but by no means to such an extent as that instanced in the case of the steel.

REINFORCED CONCRETE FACTORY, MINNEAPOLIS, MINN.
Showing Concrete Beams and Ceiling and Construction of Concrete Floor.

While the use of reinforced concrete is older than steel construction, it is only the low price of Portland cement that has brought it rapidly to the front. During the time that cement was expensive it was naturally used sparingly, and it is a fact that this custom has had an unfortunate influence in the introduction of reinforced concrete. The use of too weak a mixture and the consequent failure to secure the requisite adhesion of the steel to develop the limited strength of this concrete has brought out a number of deformed bars, the advocates of each claiming special merits.

As the writer has secured, as far as he is aware, greater strength in actual construction with special arrangements of plain bars than anything claimed by the advocates of special bars, he is inclined to regard the advantages claimed for them as a somewhat imaginary quantity. In designing the reinforcement of beams and slabs advantage should be taken of the principles of continuity, since with constant section we have to provide only for two-thirds of the moment of a simple beam and we have but one-fifth of the deflection. Further, by properly lapping the rods we may double the section over the support and require theoretically but half the metal necessary for a single beam the same strength. This system of design calls for the major section of metal for the flange reinforcement over

the support, and furnishes ample provision for shear.

In constructing work in this line it is well to bear in mind that centering is a considerable item, and that each additional beam is an extra expense. This fact led the writer to use larger and larger slabs and finally to advocate construction of floors with column spacing 16 to 18 feet centers with no beam whatever, but simply a plain slab and columns. In this connection a few remarks regarding the theory of reinforced concrete may not be amiss. The theory, based upon the elastic properties of the dual materials, has been derived from experiments on beams and slabs reinforced in one direction, and agrees fairly well with the results of tests of work involving the conditions considered in this theory. The conditions resulting from reinforcement in a number of directions are, however, not properly considered in any work that the writer is familiar with. Mr. Charles F. Marsh makes this statement in his work on reinforced concrete, Part 5: "Unfortunately it cannot be said that we have a thorough knowledge of the properties of reinforced concrete. It may be that we are wrong from the commencement in attempting to treat it after the manner of structural iron work, and that, although the proper allowance for the elastic properties of the dual material is an advancement on the empirical formulæ at first employed and used by many constructors at the present time, yet we may be entirely wrong in our method of treatment. The molecular theory—that is, the prevention of molecular deformation by supplying resistances of the reverse kind to the stresses on small particles—may prove to be the true method of treatment for a composite material like concrete metal. This theory is the basis of the Cottancin construction, which certainly produces good results and very light structures, and Considere's latest researches on hooped concrete are somewhat on these lines." As the writer has been able to place a test load on slabs equal to two or two and a half times their figured ultimate strength by the formulæ presented in Mr. Marsh's treatise, without injuring the construction nor apparently developing more than a third of its ultimate strength, he is inclined to agree with Mr. Marsh, and is in the habit of designing these slabs and guaranteeing them, not on the basis of text-book theories, but by the known relation of the new slab to the slabs tested as regards the depths and the moment of the superimposed load.

As regards the materials for our aggregate, as a matter of economy we use either crushed stone and sand or sand and screened gravel or, where the natural gravel is suitable, the gravel without screening. In crushed stone the harder the stone the stronger our concrete. For reinforced work we use a mixture of about equal parts of sand and crushed stone, ranging in size from a pea to ⅝ or ¾ inch in diameter and about 1¼ to 1½ barrel of cement to the cubic yard of concrete. For columns we find it cheaper to secure the compressive strength by the use of a rich mixture, from 2 to 2½ barrels per cubic yard. We can depend on such concrete showing a crushing strength in cubes upward of 6,000 pounds per square inch, and can readily keep the size of our columns to reasonable dimensions, with ample strength. The system of reinforcement that we use consists of a fair percentage of vertical reinforcement used for columns, with riveted hoops at intervals of the length. Where we do not employ beams we bend the vertical reinforcement outward, making an enlarged cantilever top to the column, which is buried in the slab and supports the slab reinforcement, and we reinforce the slab in four directions. Where we employ beams we prefer to break the floor up into panels, rectangular and, if convenient, approximately square, and reinforce our slabs in two or more directions. If we are using gravel for the aggregate we sample this carefully and vary the amount of cement, dependent upon the character of the material. If the gravel contains some clay and considerable finer material we use a larger percentage of cement, endeavoring to get practically the same results, regardless of the composition of the aggregate. Many have the idea that crushed stone has some peculiar advantage over shingle or the round stones that we find in our gravel. The results of a series of quite comprehensive tests made at Duluth by the Great Northern Power Company were kindly furnished the writer by Mr. D. A. Reed, their assistant chief engineer. The mixture, as I recollect, was practically a 1-3-5. The aggregate was crushed shale rock first, crushed Duluth granite second and lake gravel third. My recollection of the percentages of these tests is that the crushed granite, which is practically a hard trap rock, only showed a little over 90 per cent. of the crushing strength of the gravel concrete, and that all the results seemed very satisfactory, running from 3,200 to over 4,000 pounds per square inch.

In mixing the material enough water should be used for reinforced work so that the mixture should have the consistency of brick mortar and flow slowly to fill

the molds. No tamping should be required, but even with this mixture a certain amount of puddling and jarring or shaking of the reinforcing rods is desirable if the best results are to be secured. Where practicable, as much of the work should be run in at the same time as possible, since a beam or a slab which is spliced will show much less stiffness than one which is cast at one time, a condition which can be readily accounted for by the shrinkage strains in the concrete.

A question wich is quite frequently raised, and concerning which many architects seem to be worried, is whether reinforced concrete can be successfully executed in winter. In engaging in this line of business the writer will say frankly that this question gave him some little concern. His previous experience in building bridge piers when the temperature was at times 25 or 30 degrees below zero caused him to consider it practicable to execute reinforced concrete work in the winter, and we are now carrying it on every day just as we would in summer, except for the slight inconvenience that we have to keep the snow and ice out of our forms until we can fill them with concrete, and are obliged to heat the material that we use. When this is properly done freezing does not appear to damage the work as much as too rapid drying in the hot summer months.

We have put up nearly all kinds of structures — office buildings, machine shops, warehouses and paper mills—and the writer has recently designed reinforced concrete floors for a large power station, in which there are to be three of the largest vertical generators that have been built, having a capacity of 7,500 k. w., with 25 per cent. overload. These are to run at the rate of about 380 revolutions a minute and are to be supported on a reinforced concrete slab of about 21 feet span.

THE USE OF CEMENT FOR FARM PURPOSES.

By S. M. Woodward, U. S. Dept. of Agriculture, Washington, D. C.

Under the general title of rural engineering, that branch of the United States Department of Agriculture with which I am connected—namely, the office of experiment stations — endeavors to obtain and disseminate among the agricultural population of the country all information bearing on the various lines of engineering, with the exception of road construction, which will be of use to the agriculturist in promoting his prosperity.

We have been collecting and are preparing to issue in bulletin form information regarding the use of cement in farm construction in both this country and abroad. It will be the aim of this publication to show the advantages of the use of cement and concrete for permanent structures, to show the methods and cost of the use of cement in such detail that farmers shall be able to decide rationally as to its advantages, and, in general, to encourage and extend its use wherever it seems desirable.

Residences, barns, ice houses and silos may be advantageously built entirely of this material, either in the form of concrete blocks or in monolithic construction, or it may be used only for foundations, for cellar floors, barn floors, feeding troughs and mangers. It will serve for pavements of yards, walks and approaches to buildings where mud is especially likely to accumulate, steps and inclines, hitching posts, fence posts, watering troughs, etc.

Time is lacking to consider all these items in detail, but perhaps a few general remarks may not be out of place. Where concrete is used for floors and pavements on which animals sleep provision must be made for ample bedding in cold weather to counteract the coldness of the pavement. On any pavement for animals the finished surface must be carefully left sufficiently rough that slipping will not be dangerous. For use with water the concrete must be made with special care to secure as impervious a product as possible. In cold climates exposed work must be so made as not to be injured by alternate freezing and thawing.

Watering tanks and troughs are perhaps rendered safer from injury if the interior surfaces are given a slant such that ice can not exert a pressure perpendicular to the surface. In the case of posts, many kinds and shapes, with various types of reinforcement, have been tried, and perhaps much remains to be learned, but this field seems destined to become a very important one, and a fortune is awaiting the one who can develop the field by showing how this use may be economically and satisfactorily accomplished.

The manufacture of pipe for use in sewerage and drainage has been widely un-

dertaken and has naturally met with as many difficulties as usually attend efforts in a new direction. But these difficulties have been gradually overcome, and there seems to be no doubt that cement pipe can be readily made suitable for these purposes.

In connection with the diversion and use of water in irrigation cement has a wide usefulness. Concrete is an admirable material for dams, head works of canals, regulating gates, drops in canals, division gates, bridges over and culverts under canals, canal linings, measuring and division boxes, distribution flumes and pipes, small reservoirs and reinforced conduits. Some of these structures are in the domain of engineering rather than of agriculture, and our attention for the present will be confined to such features as are related most directly to the farmer.

Cement lining for canals has been used in numerous places, but the first and perhaps the best-known case is the Gage canal, at Riverside, in Southern California. This canal is about twenty miles long, with a carrying capacity of 37.5 cubic feet per second, and was lined throughout about 1890.

The advantages secured by the use of the cement lining are a great saving in water from the cutting off of seepage, a great reduction in the number of interruptions to the service of the canal from breaks caused by the work of burrowing animals and by seepage in the fills, a large saving in the cost of annual repairs, and the prevention of the growth of vegetation in the canal with the consequent diminution in its carrying capacity.

Preparatory to putting on the cement surface all vegetation was removed from the canal, and the bottom and sloping banks were brought carefully to the alignments, slopes and grades determined and fixed by the engineer. Wherever in this process any filling was required it was made of well-tamped clay. As an additional precaution to secure strength and permanence, wherever the canal was in fill or where any large part of the banks or bottom was in fill that part was first covered with a 5 to 6-inch layer of masonry, made of good stone laid in cement mortar composed of 1 part Portland cement, 3 parts fat lime and 20 parts sand. The surface of the stone work exposed to the water of the canal was plastered with a layer of cement mortar ⅝ inch thick of 1 part Portland cement to 4 parts of sand. Much the greater portion of the bottom and banks of the canal was not protected by stone, but cement plaster of the same composition as above, 1 to 4, was laid directly on the clay. The plaster was thoroughly compacted and troweled hard and firm to the alignments and grades, and to a thickness of ¾ inch finished. An improvement which has been adopted in later work is to form a series of ribs on the back of the cement lining by simply indenting the clay surfaces before the cement coating is applied, at regular intervals and in both directions, horizontal and perpendicular, or diagonally. The indentations can readily be made with a "form" while the clay faces are moist, which they should be at the time of the application of the coating.

Repairs on this cemented canal have not been execessive, and fifteen years' experience has amply justified the expenditure and the method used.

The work was done by contract at a cost to the canal company of about 5 cents per square foot for the portion which was plastered, and 13 cents per square foot for the portion with stone-masonry lining. These figures agree closely with present prices for the same classes of work.

Cement is well adapted to the construction of boxes for the division and measurement of water. At Riverside, Cal., the water is conducted from the Gage canal through underground pipes to concrete measuring boxes on each piece of ground where the water is to be used.

In the distribution of water through the California orchards it is quite customary to use, across one side of each tract, a head flume or pipe from which the water is discharged at as many points as it is desired for the irrigation of the tract. Although lumber has been much used for flumes, it is being largely replaced by cement. A machine has been invented for making such flumes in one continuous line in place. The mixture used is 1 part Portland cement to 4 of sand. The sand and cement are mixed into a mortar and fed into the machine, which forms the bottom and sides of the flumes and compresses the mortar in one operation.

Similar flumes are also made in place by hand tamping in molds in 12-foot sections. These differ from those that are machine-made only in the use of a heavier cross-section and a leaner mixture of 1 part cement to 6 of sand and gravel.

After a flume is made, and before the mortar becomes hard, small tubes, from ¾ to 1½ inch in diameter, the size depending somewhat on the size of the flume, are inserted in the side next to the orchard. These tubes may be of tin or galvanized iron, and each has a small slide gate. There should be as many tubes between the rows of trees as there are furrows.

Flumes are made in various widths, depending upon the amount of water to be carried and the grade. Compared with pipe used for the same purpose, as described below, flumes have two disadvantages. They are in the way of surface cultivation, and in orchards they receive the falling leaves, which lodge in and clog the orifices. Hence, in orchards especially, underground pipe is now generally installed in preference to flumes.

Cement flumes are usually constructed by contract, at prices about as shown in the following table. The price covers all materials and labor, including the necessary preparation of the ground and the metal outlets and gates in the side of the flume:

Width.	*Per Foot.*
6 inches	$ .16
8 inches	.18
10 inches	.20
12 inches	.22
14 inches	.26

Both cement and salt-glazed vitrified pipes are used in place of earthen head ditches. They are placed below the surface of the ground, deep enough not to interfere with plowing, but seldom more than two feet beneath the surface, and various contrivances have been designed, some of which are controlled by patents, to distribute the water from them to a large number of furrows in nearly equal and constant streams.

A common practice in citrus orchards is to distribute the water from the cement pipes by means of short standpipes of the same material, terminating in circular or semi-circular basins of cement mortar. Each basin has about six holes in the curved portion, through wihch water is fed to the furrows. The water may be turned on or off by operating a small rubber-faced valve, which is fitted over the top of the standpipe and is flush with the bottom of the basin.

The cement pipe may either be laid in place in a continuous line by a specially designed machine or it may be manufactured in two-foot lengths and, after curing, be laid with cement joints.

Different sizes of pipe are used, depending upon the amount of water to be carried and the grade. An 8 or 10-inch pipe will carry from ¾ to 1 cubic foot per second. It is said that an 8-inch pipe will carry 1.5 cubic feet per second on a grade of 1 per cent.

For the manufacture of jointed pipe various types of collapsible sheet-metal forms are on the market. A crew of three experienced men can make, per day:

8-inch pipe	500 feet
10-inch pipe	400 feet
12-inch pipe	350 feet
16-inch pipe	220 feet

A mixture of 1 to 4 or 1 to 5 of Portland cement and coarse sand is used in making pipe. The mixture is used in a rather dry state, in order that the forms may be removed from the pipe at once. In forming the pipe it is important that the material be well tamped. After standing for twenty-four hours or, better, forty-eight hours, the pipes are turned over and the metal rings removed from the ends upon which they have been standing. The pipe must be allowed to set for two weeks to a month before being used. During this time they should be kept damp by being sprinkled two or three times daily, and should be sheltered from the wind and from the direct rays of the sun. As soon as the pipe can be

S. M. WOODWARD,
Washington, D. C.

safely handled their interior surfaces are washed with a mixture of neat cement and lime water, to reduce the seepage, which is otherwise considerable while the pipes are new. A man can wash sixty two-foot lengths of 10-inch pipe hour, using about a pound of cement per length. One barrel of cement will make eighty feet of 8-inch pipe with a mixture of 1 to 5. Cemented joints are made with a mixture of 1 to 3.

Cement pipe is ordinarily considered safe for heads up to 14 feet. Results of scattering tests have been collected as follows: Two lengths of 16-inch pipe, united with a cement joint three weeks old, did not break under a head of 20 feet or 9 pounds per square inch. A 10-inch pipe broke under a head of 20

feet. An 8-inch pipe did not break under a head of 46 feet or 20 pounds per square inch. A line one-half mile long of 10-inch pipe specially made of a 1 to 2 mixture carries constantly a head of 20 feet.

The following table gives sizes and ordinary contract prices for pipe in Southern California with the price of cement at about $2.45 per barrel, net. The price for pipe laid includes the necessary excavation and covering the pipe after laying. The price not laid is for the pipe in the yard where they are made:

Size inside diameter.	Thickness of walls.	Depth of bottom of pipe.		Price for continuous pipe per foot.	Price for jointed pipe laid, per foot.	Price for jointed pipe, not laid, per foot.
Inch	Inch	Ft.	In.	Cents	Cents	Cents
6	1⅛	2	6	18	16	9
8	1¼	2	8	20	18	12
10	1⅜	2	10	24	22	18
12	1½	3	0	30	28	24
16					45	40
20					60	50

The risers or stands for bringing the water to the surface and discharging it into furrows or portable pipes, vary in price somewhat with the different styles, but in general a simple riser with discharge openings costs about $1.75. A riser with a valve or overflow for regulating the pressure in the pipe line above in order to maintain a uniform head on the discharge openings may cost from $3 to $6.

There have been laid in Southern California several hundred miles of cement pipe at a cost of $1,000 to $1,500 per mile.

In a few places large conduits of reinforced concrete have been built for carrying irrigation water, and if these structures prove satisfactory after thorough trial they are destined to come into much more extensive use. At present reinforced concrete seems to be the most available and the cheapest permanent material for closed conduits. It has been used for making inverted siphons to carry water under moderate pressures, but according to the reports of the United States Reclamation Service it is almost impossible to make large reinforced concrete conduits to carry successfully a pressure of more than 40 pounds per square inch.

Small circular reservoirs up to 150 feet in diameter made of concrete are in frequent use in connection with irrigation from wells in some parts of the West. An ordinary contract price for such work in California is 20 cents per cubic foot.

THE VALUE OF ORGANIZATION.

By I. S. Macdonald, Milwaukee, Wis.

This, the National Association of Cement Users, is still an infant which, under proper training and nourishment, will grow to be one of the most powerful organizations of its kind in America. True it is, we are already organized into a national body, but I firmly believe that if we are to lay the foundation for an organization whose efforts will result in the permanent welfare of its members, we must go still farther. The National Association, to be the success which the character of the undertakings of its members deserves, must be the father of many local organizations. The more thorough organizing of the members of this great growing industry will be the most practical means of solving the many great problems that confront the individuals and institutions engaged in the manufacture of cement machinery, cement and its products.

One of the greatest problems that we are confronted with is the matter of educating the public. Before we can look for the growth that this industry deserves, we must take the effective means of bringing public opinion upon our side.

Another great problem is the establishing of the products of cement and cement construction in the confidence of the architect, who is today by far the strongest factor in the building world.

Another problem is that of arriving at standard specifications for reinforced concrete, for concrete block construction and for cement sidewalk construction. The necessity of a proper solution of this problem must appear evident to everybody.

The last, but not least, is the proper methods for gaining the confidence of insurance companies and building inspectors. While we realize that at a convention such as this, a great amount of expert information is given by the best technical men throughout the country, for the solving of these problems in a general way, we must remember that local conditions in different communities are widely different, and, unless the national organization brings about some means whereby these problems may be solved individually in each community, it seems to me that its greatest mission is lost.

Our president brought out the necessity of every individual or concern engaged in

all classes of concrete construction using their influence with the congressman from their district to lend his support to a bill providing for another appropriation to carry on the work of the government testing station, more extensively than the present appropriation has permitted. It seems to me that in a case of this kind the work of properly organized local organizations could be most effective.

Along these lines your attention undoubtedly has been called before this to the fact that in November last a concrete association was formed in New York City, presumably in the interest principally of the reinforced concrete construction.

The following are the declarations adopted by the association as a basis for their future operations.

(1) To inaugurate a movement in the public press and otherwise, in order to obtain fair and equitable rates of insurance upon buildings constructed wholly or in part of concrete.

(2) To secure from the building authorities a full recognition of the proper valuation in the design and erection of concrete structures.

(3) To acquaint the building and technical professions with the value of concrete as a fire-resisting material, and to present in a tangible manner the great possibilities of this material for construction.

(4) To collect and classify data relating to cement and concrete, with a view to standardizing concrete methods and regulating the design and construction of concrete structures within safe and conservative limits.

(5) To form a large and representative exhibition of cement and of concrete structures and apparatus illustrating not only the broad scope of the industry, but also the several systems and methods of construction, reinforcing devices and mechanical appliances pertaining to the craft.

I believe that the declarations laid down by this association should serve as an admirable basis for the avowed objects of concrete organizations in every large city and community in the United States and Canada.

While the following will relate more to concrete block construction than the other forms of concrete construction, I believe that there is as much reason for contractors engaged in other methods of concrete construction to get together and aid, through their mutual co-operation, bring about the solution of the problems they are confronted with.

I will relate to you the experience that we have had in Milwaukee. Building Inspector Koch came to the speaker some time ago and stated that he was compiling a new code of building laws for our city, and stated that he had gone as far as concrete construction and, to use his own words, he said, "Now I am up against it." He admitted that his knowledge of concrete construction, especially of concrete block construction, was so limited that he hardly knew where to draw the line, but that he wanted to be fair and reasonable to this new method of building, and yet he felt it necessary that he should place a standard upon the manner and character of construction of this kind, such as would guard the interests of the individual citizen. He spoke very plainly of the poor quality of common brick manufactured in this vicinity, and also of the fact of our having large deposits of silica sand, such as make an admirable aggregate for cement blocks, but he said, "I do not know where to commence; I do not know where to finish." It can be said just at this juncture that the importance of having fair and reasonable regulations controlling concrete block construction is very evident. The new code as it is being drawn up by the city officials will place the fire limit in Milwaukee beyond the Menominee valley; that is, almost the entire factory district of Milwaukee will be within the fire limits. In these fire limits the new code will not permit of the erection of brick veneered buildings. Buildings must all be at least semi-fireproof. This fact leaves a great opening for material such as concrete blocks for factory construction, and it is most important that this new code should be fair and reasonable in this respect.

In compliance with the inspector's request for the co-operation of cement block manufacturers and contractors in Milwaukee, the speaker called a meeting of these gentlemen, in which a communication from Building Inspector Koch was carefully considered. After several lengthy discussions, we presented the following recommendations to the building inspector.

First of all, in fairness to all methods and systems in concrete block manufacture, it was recommended that Milwaukee should have a testing station, wherein a testing machine should be installed that would test the crushing strength of blocks. The amount of crushing strength each block should stand should be determined by comparison with that which other building materials are supposed to have. Crushing strength furthermore should be determined upon the total area of the surface of the block. I will say with reference to this that the building inspector declared that when this code was adopted he felt satisfied that our mayor would supply us with the testing station,

as well as one of the latest types of testing machines, and that these tests would be made without expense to the block manufacturer or contractor. It was further recommended that it should lie within the jurisdiction of the building inspector to determine the strain test of the wall while it is under construction, and at such stages as should be deemed advisable by the building inspector.

It was recommended further that blocks should be manufactured thirty days before they were permitted to enter into the construction of a building, with the proviso that if a contractor had sufficient confidence in the short-time cure for his blocks, according to the system he employed, to place such blocks in a building before the thirty-day time limit, before proceeding with the erection of such building he first must place a block with the building inspector, who shall not test same until after the expiration of thirty days, and if such is found wanting in its crushing strength said contractor should be required to tear down his wall. This proviso was inserted because of the reason that some block manufacturers believe in the system of curing blocks by steam, and, inasmuch as there is considerable discussion for and against this system, it was thought best to recommend a clause that would be fair to both.

The recommendations still further say that it shall rest within the jurisdiction of the building inspector to go to a building when under course of erection, if he is doubtful of the uniformity in the quality of blocks and pick out such blocks as he desires for a test, and if such blocks do not comply with the regulations determining the crushing strength a block should have, and if the wall will not stand the required strain test, the contractor shall be required to tear down his building.

It was also recommended that it rest with the building inspector to test the cement used in the manufacture of blocks as well as examine the aggregates.

Portland cement was recommended to be used exclusively in the manufacture of concrete blocks.

It was deemed advisable furthermore that the manufacturers of concrete blocks be licensed, and that they put up a reasonable and just bond with the city, as a guarantee that they will live up to the requirements of the law in these matters and the instructions of the building inspector.

By way of explanation of this last clause, I would say this action was not taken with a view of excluding the small man. The bond recommended to be required was not a cash bond, but a bond of a reasonable amount signed by two representative, responsible men, much on the order of the bond required by the city for cement sidewalk men. This action was taken merely for the protection of the industry in the city of Milwaukee, and when it is realized how critical public opinion is in its judgment of any new industry, it was believed that some action of this kind should be taken, not because it was thought that the bond would have to be forfeited at any time, but to aid in the establishing of the concrete block industry in the confidence of the architect as well as the general public.

It was further suggested that this part of the code should be made reasonably stringent to guarantee a high standard of blocks, and that blocks made under reasonable regulations be equally entitled to the recognition in the code for the construction of all classes of buildings, with any other building material.

It was believed that in the portion of the building code specifying materials that may be used for outer walls, for division walls or furring, etc., it should include concrete blocks, and not have them inserted in the code as they are at present, as an auxiliary material.

These were the recommendations as laid down by the concrete block manufacturers in Milwaukee, their object being throughout to have this portion of the code drawn up in such a manner as to protect the industry in every particular, place it in the confidence of the public and the architect, also to require a standard of material such as would give concrete blocks a right to demand recognition on an equal basis with other building materials.

While this has possibly no direct bearing upon the subject, my object in bringing this matter up is simply to show what may be done in each locality by a properly conducted local organization. I might add that within a very short time we believe that in Milwaukee we shall have the most favorable code toward concrete blocks of any city in the United States. I believe that many of the codes that have been adopted of late, as well as amended in several cities, are very unfair to concrete block construction as well as reinforced concrete construction. I believe also that had there been local organizations of concrete block manufacturers as well as reinforced concrete contractors in the cities where these new codes have been adopted, they could have brought influence to bear upon the building department through a campaign of education of the authorities, that would have resulted in much more favorable laws. Each locality has its own individ-

ual conditions, and these conditions must be met in an individual way, and this is only possible through active work by a thoroughly organized local association.

There is also the labor problem which concrete block manufacturers have to deal with. There is the ruinous competition now existing among block manufacturers. This, I understand, has been so keen of late that many block men are selling their blocks below their actual cost to themselves. This could all be avoided.

WATERPROOFING.

By J. L. Mothershead, Jr., Indianapolis, Ind.

The waterproofing of concrete blocks is a subject of the greatest importance to all who are in any way interested in the manufacture of this building material. I think it may safely be said that the life of the whole industry depends on it.

The common clay brick are not waterproof, but the public has become so accustomed to their use and to their disadvantages that in getting something to take their place we must have an article which has all of their advantages and none of their disadvantages; consequently we must build dry houses with concrete clocks and without furring, or the public will soon stop using the blocks.

The first culprit is the manufacturer of machines, who sells one to a lawyer, doctor or some other such inexperienced worker in cement, and then leaves him to work out his own salvation.

Then we come to the block manufacturer who believes that any Tom, Dick or Harry can make good blocks, and that all he needs is some dirty sand and a little cement. He sells a few blocks because they look all right, and that is the only test that the customer knows how to apply. As the blocks are poor, they give rise to constant trouble, and during the rainy season the water goes through the walls in which they are placed as it would through a sieve.

But the man who injures the industry the most is the one who buys a machine and goes to making his own blocks on his building site, using poor material, without proper mixing, and then as time is an item he puts the blocks into the wall without any curing. My attention was attracted to a cement house in Indianapolis, which was built in this manner. The blocks were so poorly made that with a small stick you could dig holes in them. I reported it to the building inspector, but he seemed unable to do anything, and so the house stands today as an example of concrete block construction.

First, make good blocks. We have before us the question of making them correctly. It is impossible to attempt waterproof houses unless the blocks are well made and well cured. Too much cannot be said on this point, and our only hope is that the quality of the average block will improve as the industry grows older. That is the first thing to strive for; honest material, made into blocks in an honest manner and well cured. This alone will not produce waterproof blocks, but we must have it as a foundation or any special design or use of chemicals will fail.

Second comes the use of a richer material as a facing for the blocks. All reasoning tends to condemn this method, as there will be two rates of contraction and expansion in the same block, and the natural result will be a splitting apart of the two mixtures. Some manufacturers claim that by making the blocks face down the danger of the occurrence is removed. Perhaps it is, and perhaps it is not; experience alone will show, but one fact must be considered, and that is that when a block is made face down the forces exerted in the manufacture of it are at right angles to the direction in which the force is applied when the block is in the wall. This seems like a waste of opportunity for making a strong building.

I was walking around the yard of a well known block manufacturer, and we were talking about faced blocks. During the discussion we examined some blocks which had been made in this manner three years ago, and found cracks between the facing and the remainder of the block. This man is a progressive, conscientious block maker, and I have every confidence in the blocks which he turns out, and consequently our discovery somewhat shattered my faith in faced blocks.

Third, we have the two-piece system. In this class we put all blocks in which there is no direct concrete partition between the inner and the outer wall. I can see no reason why this system should not be perfectly satisfactory as regards making a dry house. Whether they are strong enough and easy of construction, etc., is a matter outside of my province.

Fourth, I want to consider the addition of chemicals to the concrete in the course of manufacture. About a year ago I experimented extensively in adding various

mixtures of chemicals to cement and making briquettes and testing them for strength. Some chemicals, of course, were very injurious and some highly advantageous.

It has always been my theory that the ideal method of waterprofing concrete was by adding a chemical during the mixing of the sand and cement, and my work was along that line. I may at his point state that I discovered a material which, when mixed with concrete, had wonderful effect on it. The blocks containing this chemical were white in appearance, absorbed about ½ per cent. of water, of increased strength and density. I did not put this on the market as it increased the cost of a block a couple of cents, and my observation of the trade has been that it is after quick returns and the manufacturer does not care for anything which reduces his immediate profit, no matter how large his future returns may be.

I also experimented on the addition of various salts to cement, and found that they did not decrease the porosity to any noticeable extent, so they were of no use to me in waterproofing.

I did, however, find that they shortened the time of setting to such an extent that the results of strength tests after 48 hours showed sometimes as high as 100 per cent. increased strength. Also they allowed the use of cement in temperatures several degrees below freezing.

Such salts as chloride of barium and chloride of sodium (common salt) were the best for this purpose.

One of my experiments showed after 48 hours:

Common cement, 90 pounds.
Chloride of calcium, 167 pounds.
Chloride of magnesium, 55 pounds.
Chrolide of barium, 232 pounds.

The addition of these ingredients, however, increased greatly the efflorescence, as they are water soluble, and the discoloration of cement is caused by water soaking in the blocks and then coming to the surface to deposit the salts after the evaporation of the water.

This, of course, is a great disadvantage, and should be carefully guarded against by the block manufacturer in buying preparations of secret composition.

I also would like to touch on the use of lime in mixing the blocks. The practice is becoming quite general, and I believe largely through ignorance on the part of the manufacturers. You all know that lime in the usual form is detrimental to the strength of the block, but a great many believe that the hydrated form is safe to use. This is a mistake, and should be carefully guarded against. I read an article in one of the magazines devoted to cement, recommending the use of hydrated lime for waterproofing, and was very much surprised to find such ignorance on the part of the editor.

The hydrated lime when used in the blocks is attacked by the carbonic acid in the air and changed to carbonate of lime, which has a tendency to disintegrate the blocks and deposit a white stain on the outside. Lime does undoubtedly whiten the blocks and make a better looking article, but no experienced maker will use it if he wishes to firmly establish his business.

The first quick success of the block business will be its death stroke if we are not careful, for the manufacturer has flooded the market with a lot of cheap, poor blocks, and the cry seems to be "After us the deluge." But it won't be after us, but on us.

MANUFACTURE AND USE OF CONCRETE PILES.

By Henry Longcope, Philadelphia, Pa.

All of us have frequently seen piling used in many ways, and if my own experience is a criterion few of us have ever given this matter serious consideration and have taken the whole subject as a matter of course; but when we go into closer investigation we find that piling has an ancient and honorable history, beginning with the prehistoric race of Lake Dwellers, who at one time inhabited one portion of Europe, and traces of their ancient foundations have been discovered from time to time, showing that the pile played an important part in their social economy. It is probable they drove their piles with crude instruments, some distance from the shore, in order to protect themselves from land attacks by their enemies. Through the natural course of evolution, the crude idea was perfected by engineers, who saw that wooden piles were subject to decay and the attacks of the teredo worm, and as a consequence sought a material that was more substantial.

The first innovation was the sand pile, produced by driving a wooden form in the ground and withdrawing the same, the hole being filled with moist sand well rammed. The next method adopted was

to drive a metal form into the ground and after withdrawal to fill the hole with concrete; but this was not successful, as it was open to the serious objection that on withdrawing the form the ground would collapse before the concrete could be inserted. Still another method was introduced, which consisted of dropping a cone-shaped piece of metal, weight five tons, a number of times from a considerable height, in order to form a hole, which was afterwards filled with concrete. This method never passed the experimental stage. Later a plan was devised to mold a pile, using concrete, reinforcement sometimes also being used. This pile was allowed to stand until perfectly hard, when it was driven in a similar manner as now in vogue. To prevent the concrete pile from injury, a drive-head or cap was so arranged as to deaden the force of the hammer blow. Gilbreth uses a molded taper pile, cast with a core hole the entire length of the pile, which is jetted down by a water jet and finally settled by hammer blows. Still another method is used by Raymond. Under this system piles are usually put in by either of two methods, the jetting method or the pile core method. The water jet system is used only where the material penetrated is sand, quicksand or soft material that will dissolve and flow up inside the pile when the water is forced through the pipe, thus causing the shell to settle until it comes in contact with the next shell, and so on until the desired depth has been reached. The shells are filled with concrete simultaneously with the sinking process, and when necessary spreaders are attached to keep the whole in perfect line with the pipe. The ½-inch pipe is left in the center of the pile and gives it greatly increased lateral strength. If desired, the lateral strength may be further increased by inserting rods near the outer surface of the concrete. By this method, piles of any size up to two feet in diameter at the bottom and four feet at the top can be put through any depth of water and to a suitable penetration in sand or silt (water sediment).

The pile-core method is the one most generally used for foundation work and consists of a collapsible steel pile core, conical in shape, which is encased in a thin, tight fitting metal shell. The core and shell are driven into the ground by means of a pile driver. The core is so constructed that when the desired depth has been reached it is collapsed and loses contact with the shell, so that it can be easily withdrawn, leaving the shell or casing in the ground, to act as a mold or form for the concrete. When the form is withdrawn, the shell or casing is filled with carefully mixed Portland cement concrete, which is thoroughly tamped during the filling process.

The simplex system uses another method in which the driving form consists of a strong steel tube, the lower end of which is fitted with powerful tooth jaws, which close together tightly, with a point capable of penetrating the soil when driven and also capable of opening automatically to the full diameter of the tube while being withdrawn. The point of the form closely resembles the jaws of an alligator, and was so named by the colored laborers. At the same time the form is being withdrawn, the concrete is deposited. The form, as carried out in actual practice, is constructed as follows: A stock length (about 20 feet) of 15 inches outer diameter pipe ½-inch metal is reinforced at the upper end by means of a band of ½-inch boiler steel, 18 inches wide, rolled into a cylinder to fit tightly around the pipe and riveted to it by means of three rows of 1-inch rivets, 8 rivets to the row. The rivets are countersunk and have slightly oval shaped heads. This band has been found necessary to prevent the upsetting action of the hammer, and its depth, 18 inches, has been found by practice to be the minimum to prevent the buckling of the tube, although it seems well nigh impossible to construct a form which will entirely resist the repeated blows of the heavy hammer, the only solution being to build all of the apparatus of such rugged nature as to reduce the punishment to a minimum. Four large holes are bored 90 degrees apart through the band and pipe, to accommodate the 2-inch pins which connect the pulling tackle to the form.

The lower end of the pipe is riveted to a cast steel sleeve, having the same inside diameter as the pipe, but of 1½ inches thick metal, making the outside diameter 17 inches; the pipe is turned off true and fits with a driving fit into an 8-inch deep socket turned into the sleeve. Two rows of twelve 1-inch countersunk rivets with flattened heads connect the sleeve to the pipe. To this sleeve are attached two cast steel jaws in such a manner as to permit them to swing freely. These jaws are segments of a true cylinder, the same size as the sleeve, namely, 14 inches inside diameter and 17 inches outside diameter, formed by two planes cutting in at approximately 30 degrees to the axis, and the second at right angles to the first and intersecting a little short of the axis. When brought together they form a clam shell point, absolutely tight and well adapted for penetrating the soil, but when hanging open they form a true cylinder of the full opening of the pipe.

The interlocking of the jaws binds them together so that they act as one solid piece. The jaws are usually closed together and held by two small tapered pins, or a small clamp, which is destroyed during the driving and comes off when pulling the form from the ground.

The driving form consists of a stock length about 22 feet of large diameter pipe, reinforced with a band and fitted at the bottom with an alligator point. Additional lengths can be easily coupled by means of a band and rivets.

The pile driver used generally is similar to that used in driving ordinary wooden piles. A sliding purchase cap is arranged near the top of the driver and from it is suspended the pulling tackle, consisting of a quadruple steel block and a quintuple steel fall reeved with a ⅝-inch plow steel wire rope, which runs over a single steel block and thence to the engine.

The hammer weighs 3,000 pounds, and the engine is any style of an approved type hoisting engine.

On the top of the driver are mounted three sheaves, the middle one for the 1½-inch hammer line and one on either side for the bucket line and the rammer line, respectively.

The pile is produced in this way: the driving form is swung up into the leads, with closed jaws, it is then lowered until it rests on the ground and has buried its nose in the soil. The pins are removed, the pressure of the soil holding the jaws together. On the top of the form is placed a steel drive-head with a tenant underneath to engage the pipe and provided on the top with an oak block to take the shock of the blow. The form is then driven to the required depth; the hammer with the drive-head attached is raised to the top of the leads, and toggled by swinging out the purchase cap carrying the pulling tackle. The fall is connected to the driving form and made ready for pulling it out of the ground. The rammer is a cylinder of cast iron 6 inches in diameter and weighs 30 pounds. This is lowered to the bottom of the form and a target is fastened in the rope flush with the top of the form. The rammer is raised half way up in the tube and a bucketful of concrete, which makes about 4 feet of pile, is hoisted in a bucket having a falling bottom, and emptied down the tube, striking the bottom with considerable impact. The rammer is lowered until it rests on the concrete, which would show the target about 4 feet above the top of the form; the form is pulled up until the target on the rammer line is 1 foot above the top of the form, which indicates that the jaws have opened and the concrete has passed through with the exception of a 1-foot head of concrete left in the form to prevent any particle of soil from getting into the concrete; the rammer is raised and let fall frequently to insure perfect ramming; then the rammer is raised half way up in the tube as before, and a second bucketful of concrete is emptied and the process is repeated until the hole has been filled and the form withdrawn.

The concrete used consists of 1 part Portland cement, 2½ sand and 5 parts broken stone, graded.

A modification of the method just described is to fill the form with the required amount of concrete, sufficient to make a complete pile, and a ramrod, which is merely a piston head with a rod fastened to it, upon which the hammer is lowered, but not struck; the form is then pulled and the hammer gradually settles, showing that the concrete is spreading out below, as the form is withdrawn, or, in other words, filling up the entire space previously occupied by the form.

In order to prevent voids another precaution is taken by furnishing the men with comparative tables, indicating the amount of concrete which should be inside the form, in order to make the required length of finished pile. If, on raising the form, the concrete should slop over, it would show that voids existed, and therefore the personal equation would be present here, as it is in all other operations.

In certain conditions of soil, such as deep fills of rubbish, cinders or light, loose materials, a cast iron point, generally of a similar shape to the alligator point, is used. There is no sleeve or jaws whatever on the end of the form, there being nothing but the plain length of pipe. The cast iron pipe is located on the proper center, on the ground where the hole is to be driven, the pipe form is lowered over this point and driven to the required depth; the method of withdrawing the form and filling is exactly the same as the method before described for alligator points, except in the case of the cast iron point, which remains in the ground as obviously it cannot be withdrawn.

It is so evident that concrete is vastly superior to wood in the construction of piles that it is almost superfluous to mention the points of superiority. Concrete is not subject to rot or the ravages of the teredo worm, neither can the piles constructed of concrete be destroyed by fire, and no cost is attached for repairs. While it is not possible to give accurate statistics as to the life of a wooden pile, as it varies so much under different conditions, yet we know that in some cases they are rendered worthless in a very few

years, especially when the material which surrounds them is composed of rotted vegetation, or where the pile is exposed by the rise and fall of tides. It is also impossible to state the exact cost of a concrete pile, as it varies also according to conditions. Ordinarily speaking, a concrete pile will cost from one and one-half times to two times as much as a wooden pile; but in order to illustrate where a saving can be made, the following extract from a letter to the Raymond Concrete Pile Company, under date of May 24th, 1905, relative to the piles which they drove at the United States Naval Academy at Annapolis, Md., is given, viz.:

"The original plans called for 3,200 wooden piles cut off below low water with a capping of concrete. To get down to the low water level required sheet piling, shoring and pumping, and the excavating of nearly 5,000 cubic yards of earth. By substituting your concrete piles, the work was reduced to driving 850 concrete piles, excavating 1,000 cubic yards of earth and placing of 1,000 cubic yards of concrete."

In the work mentioned, the first estimate for wooden piles placed the cost at $9.50 each, while the estimate for concrete piles was placed afterwards at $20 each, yet the estimate based on the use of wood piles aggregated $52,840, while the estimate based on the use of concrete piles was $25,403, or a total saving in favor of concrete of over $27,000.

One question which arose in my mind when I first started my investigation was whether the pile when completed was one solid mass, or whether it was full of voids or soil. In several instances the piles were uncovered to their full depth, and they were found to be perfectly sound in every particular. By surrounding the operation with the safeguards provided, it is almost impossible to make a faulty pile. The concrete is made as wet as good practice will allow. Constant ramming and dropping the concrete from a considerable height tend to the assurance of a solid mass, then the target on the ramming line or the introduction of an electric light into the form shows what is being done at the bottom of the form.

CAUSES OF FAILURES IN THE CONCRETE BLOCK BUSINESS.

By O. U. Miracle, Minneapolis, Minn.

It certainly would be presumptive on my part to assume to tell you all the causes of failure or lack of success in the concrete-block industry. Many theories may be found inefficient when put to practical tests, so I shall only treat the subject in the light of my own observations in the field, and shall point out the most glaring dangers which seem to confront us, in order that we may overcome them.

In looking over the field I find that failures are due to a great variety of causes. Right here I want to again remind the manufacturers of concrete machinery of the grave responsibility of the position which they occupy in this matter. The field has proven such an interesting one that it has attracted investments by men in all walks of life. Many have engaged in this business whose fund of knowledge on the subject was of necessity limited. They have largely depended for their information upon the literature put out by the various machinery manufacturers. This information has in many cases, either through ignorance of the subject or a desire to make the proposition look more attractive than it really was, been very misleading. and the instructions given, if followed, would in many cases result in dire disaster. I most earnestly urge that the machinery manufacturer, in preparing his literature, confine himself to facts. Even in the past few weeks I have seen literature in circulation, from what I considered reputable concerns, advertising certain cement-block and brick machines which which gave the estimated cost of the manufactured product at less than the cement alone required to produce a good article would cost. A gentleman told me that he had about made up his mind to buy a certain type of machine because the manufacturer told him it pressed the blocks so hard that they could be laid in the wall the next day after making. These rash statements often come from the over-zealous salesman, but altogether too often from the machinery manufacturer himself.

In almost all estimates of cost of manufacture I find that account has been taken only of the direct expense. No mention whatever is made of indirect expense, such as advertising, superintendence, interest on the investment, depreciation, loss from breakage, bad accounts, etc. There is sufficient profit in the business to place it on a much higher plane than has been aimed at by many manu-

facturers. The facts of the matter are, including all these extra items of expense, there is still more chance for gain in this business than in the manufacture or production of any other building material of equal strength and lasting qualities. Up to the present time we have been very lame in the lack of standard specifications for the manufacture of this product. In order to get this matter on a uniform basis it was brought up at the meeting of the cement-block manufacturers, held in Chicago last June, and, as chairman of the committee, I hope to submit a progress report at an early date.

Within the past week a case has been brought to my notice where the party failed absolutely. He did not attempt to secure any business on merit; he had the idea that he must always be below his competitors to get orders. Under these conditions, what could you expect but inferior material and poor workmanship and a dissatisfied customer, who uses his influence against cement work at every opportunity?

Then we have the man who goes into business with insufficient capital. Some manufacturer has sold him a machine or partial equipment simply because he had the price or a part of it; he gets credit of his local dealer to the extent of the price of a few barrels of cement at a good round price. He makes a few blocks and sells them while they are yet too green for use in order to get funds for his pressing needs. He discovers, on account of his men being new to the business or for some other reason, that the blocks cost him much more than he anticipated or twice as much as the over-anxious salesman told him they would. He is short on profits and has already established a selling price at too low a figure. The tendency then is to attempt to make a profit at the already established price by cutting down the amount of cement used and correspondingly increasing the amount of sand. The results are too well known. He is down and out in a short time, condemns the business in general and the machine in particular that he bought, and is not slow to discourage others. By the time the report of his failure gets into about the third or fourth hands the conditions responsible for the results are lost sight of, and the report is spread broadcast that the business is a fizzle.

Next we come to the architect. He occupies a very important relative position in this matter, and his adverse criticism has no doubt proven a stumbling block to many of you. The value of his opinion and indorsement has been too lightly estimated by many. His position has of necessity been one of great care and caution. He is not willing to depart from fields of well-known practice for the mere novelty of an experiment. His position must be secure, but he has been a very careful student of the concrete block, and where a year or two ago he turned a deaf ear to the proposition he has discovered now that the material is already established, and he is willing to consider it for his requirements. His first and most important objection is lack of quality. Assure him of this, and he is ready to make a beginning. But he is immediately confronted with the question of appearance and utility. His objection as to appearance is certainly justified by certain glaring examples. It is lamentable that a material so easily susceptible to artistic designs has been so shamefully treated. Each of you can bring to your mind a building of concrete blocks, every one of which is of exactly the same size and the same style of rock-face design, with no sign of an attempt of ornamentation. There is no legitimate excuse for this neglect, and do you think it is any wonder that Mr. Architect finds fault with the appearance of this kind of a building? He can get the same effect in appearance with the cheapest kind of boards covered with still cheaper stamped sheet iron. We wants more variety of design, and if you will set about it there is nothing easier than for you to give it to him. True, additional design means added expense, but you will be placing the business on a higher plane and your profits will increase correspondingly.

I have visited many yards where the owners were making less than half the designs and sizes of block their outfit was capable of turning out. While it is true there has been a demand for this rock-face block which you all make, I hope the time will soon come when you will get away from this idea entirely. It is at best but an imitation. As I have said on other occasions, I believe that this material is entitled to a distinct classification of its own, and a building made of it should be designated as a concrete building, and not as artificial stone, as so many call it.

One of the handsomest buildings I have ever seen of concrete was made of all plain-face blocks for the body of the building, with bevel quoins at the corners and openings, with a few ornamental designs utilized as belt course and cornice.

Another just objection of the architect is the extreme porosity or permeability of many blocks. This, combined with

the strength of the material, is the all-important part of this proposition, and these objections are being rapidly overcome. This comes properly under the subject of manufacture and specification, and I shall only touch lightly upon it, as so important a subject is worthy of more lengthy consideration. The results obtained in this direction depend upon the following five vital points:

First—Proper selection and proportioning of materials.

Second—Careful mixing and complete incorporation of the ingredients.

Third—Careful and thorough tamping.

Fourth—Care in curing.

Fifth—Care in laying.

Proper Selection and Proportioning of Materials. — The cement should in all cases be a first-class Portland. In the selection of sand and aggregates the greatest care should also be exercised. Sand should be practically free from clay, loam or other soluble matters, notwithstanding the fact that many tests have shown that a small proportion of clay is not harmful. I believe it to be a very dangerous practice to recommend the use of sand containing any perceptible amount of clay from the fact that the average worker has no facilities for determining the percentage found in his material. If possible, the sand should be graded in sizes so as to reduce the voids to the smallest possible amount. The percentage of cement used with the sand should be such as to perfectly fill these voids. For determining the voids the water test may be employed without laboratory facilities. Average sand is found to contain 25 to 35 per cent. voids, indicating the necessity of using this percentage of cement to make a perfect sand-cement mortar. Where aggregates are employed the voids in the aggregate may be determined in the same manner as they are in the sand, and an amount of the sand and cement mixture equal to the amount of voids in the aggregate should be used to make a perfect stone.

Careful Mixing and Complete Incorporation of the Ingredients. — Machine mixing is at all times preferable and invariably produces a better concrete by at least 10 to 15 per cent. than can be made by hand mixing. The materials should be thoroughly incorporated and mixed until of uniform color.

When an aggregate is used the sand and cement should be well mixed first; then the aggregates and water may be added at the same time.

I believe that with any of the machines now on the market a much wetter mixture can be used than is generally employed if proper care is taken of the face plates. The face plates should be kept clean with a wire brush and be given a coat of oil or shellac as frequently as once a day.

Careful and Thorough Tamping.—The tamping should commence with the placing of the first shovelful of material in the mold, and should continue until the mold box is full. A small face tamper should be used, and quick, sharp blows should be struck.

Many unsightly buildings have been put up of blocks which showed unevenness in their texture on account of careless and uneven tamping.

Care in Curing.—No part of the manufacture of concrete blocks is more important than the curing, and I regret to say that this essential part of the manufacture is altogether too frequently disregarded.

Blocks should be kept moist for at least seven days after making. The water should be applied with a spray or sprinkler immediately after the initial set has taken place, or as soon as it can be applied without washing the stone.

Another fault that I have discovered in this connection is the fact that many yards do not carry sufficient stocks of blocks on hand—they wait until they have secured the contract before making the stone, and they are in this case rushed into the building too green, and bad results will inevitably follow. No concrete stone made in the manner above described should be laid in the wall until it is at least thirty days of age. Green blocks should never be exposed to the rays of the sun or warm currents of air during the first seven days, when they are supposed to be kept moist. In the early stages of this business I have seen blocks made under an open shed, immediately placed out on a hillside, exposed to the sun and wind, with no water applied, except such as was pumped with a common wooden pump and carried in buckets, and you all know too well the results that come from this careless haphazard method.

Is it any wonder that blocks made in this manner are porous or that they absorb moisture readily?

Many of you have seen buildings of concrete blocks which showed bad cracks in the wall. A building of this material though built of any other substance, but in nine cases out of ten where I have found cracked buildings I have found this result came from laying the blocks in the wall too green. They must have at least thirty days in which to cure, and they are better if they are sixty days or even six months old.

Care in Laying.—Too great stress can not be put upon this important part of

the business. A mortar of equal parts of lime and cement to two or three parts of sand should be used and all blocks carefully bedded and butted on the ends, and the joints well pointed up. This pointing should be done at the time of the laying, as, if done at some later period, the blocks are apt to absorb the moisture from the mortar, thereby loosening it so that it will drop out.

Some blocks are provided with small oval openings at the ends for the reception of a soft cement mortar. After a course of this style blocks has been laid in a wall the mason should go along the wall with a measure of mortar sufficiently plastic to pour into these oval openings. This not only insures a tight joint, but acts as a dowel to tie the wall. I have seen many jobs completed which were very unsightly on account of the carelessness of the mason in allowing the blocks to become spattered with the mortar. This can easily be avoided, and I have found it in most cases comes from masons who are prejudiced against the use of concrete blocks.

Summing up, we find that we have arrived at a very vital and important point in the progress and development of this business—we have arrived at the "parting of the ways."

There will be two distinct classes of this material—viz., good and bad, the latter coming from those lacking experience and knowledge of the business, and let us use our united efforts to set them right. If you have a new competitor in your town, go to him and tell him how to make good work, and it will invariably assist in bringing about a uniform and superior quality of concrete blocks. There will always be some failures, as there are failures in any business, but by united effort and care we can reduce these failures to a minimum.

CEMENT BLOCK ARCHITECTURE.

By Louis H. Gibson, Architect, Indianapolis, Indiana.

I could never have hesitated long in accepting the cement-block idea. I have hesitated long, however, in agreeing to accept cement blocks as at present manufactured. I have recognized the inherent merits of concrete construction, and from the beginning have felt that making concrete in block form was a worthy building and commercial enterprise, but as one interested in architectural work the actual results of concrete manufacture have been such that, until recently, I have felt that I could not afford to encourage and foster this industry. I am doing it now in this way, not because of any decided encouragement through specific results, but on account of what I recognize as a possibility. I know that a worthy cement block can be made commercially. My conviction rests upon the well-known and well-recognized merits of concrete as a building material and because it is desirable to fabricate it into block form. It is difficult to form concrete along proper architectural lines into structural and decorative shapes, such as monolithic walls, columns and lintels. The construction of forms of wood or other material for monolithic structures above grade is very expensive, not readily practical and by no means satisfactory for structural and decorative purposes. The block machine is the logical former of concrete for building purposes. Through its agency any shape or form may be made. Concrete will come into structural and decorative use largely through the agency of the machine.

Our highest and best thoughts may be given permanent and adequate expression through the medium of the machine and the concrete. But I have never seen an artistically successful structure executed with cement blocks. I am pinning my faith in concrete blocks to what I know can be done, and as not resting upon what I have seen done in a commercial way in a completed structure. I have not seen one worthy artistic expression through this medium. Think of it as you may, regard these expressions as sentimental if you will, say that it is all fol-de-rol if you feel that way, but bear in mind that the cement-block industry will rise or fall, you will make money or you will lose it, according as you meet the canons of artistic sentiment. Through the medium of cement blocks you must be able to do what has been done with other building material—give expression to the manifold capacities of the human intellect, with all of its hopes, ambitions and emotional flights—give them permanent form in structural material. Few of you will go into business for art's sake, yet for the dollar's sake you must produce the medium of artistic expression. This you have not done.

There are times when it pays to blurt out the whole truth. This is such a time,

and this is the truth. Architects are unfriendly to the concrete block as now made. Is this because the architect is unfriendly to concrete? I answer this question by asking another: Who has been more ready to use concrete as a structural medium than the architect? The architect wants to use the cement block. He is always looking for a new medium. The architect will tell you that when you realize the possibilities of this material he is ready to use it.

The most successful terra-cotta concern in the world makes the most artistic forms. They carry out the designs of the architect most faithfully. The most prosperous pressed-brick makers in America make the most artistic brick. They have certain stock patterns, well designed, which a self-respecting architect is not ashamed to use. They will make what he wants, but if he hasn't time to wait for the new designs there are often those in stock which he does not hesitate to employ. The architect uses stone, terra cotta, brick, and he uses them in block form. He is not using concrete in this form. This is the fault of the block maker, and not of the architect. As now made, he is afraid of it structurally and decoratively, and doubtful of the general capacity of the manufacturer to carry out his plans.

There are those among us who will say that the block maker is not ambitious to furnish material for the great cathedral, the tall office building, the impressive public structure or the modern palace; that he is willing to let this work go to the quarrymen, the stone cutter or the clayworker. If the concrete block is not for these important buildings, it is not for the cottage, the store or the factory. There is no relative difference in the structural or ideal of these problems. The $1,500 house is deserving of the same quality of attention, the same care, as the important structure.

The block situation is rather unique. Ottentimes in placing a relatively new product before the people one has to bring the people up to his ideals. The public is demanding a structurally better product, a more highly developed substance artistically than you are giving them. The opportunity is a rare one. It is for you to educate yourselves to meet the public standard. A greater opportunity never presented itself to a lot of business men.

Do not imagine for a minute that art needs help from you. It is you who need the help of art, and the foundation of your art is utility. You are not to be patrons of the arts for art's sake. You are patrons of art for your own sake, for your pocketbook's sake. You need art, art does not need you.

It is our aesthetic demands which give great value to raw material. The modern alchemists are the artist, the scientist, the engineer—men who have ideals and give them practical expression. The modern alchemist mixes the sand, the cement, gives it form and turns it into gold. This is the key to the cement-block situation to-day.

The modern alchemist who would turn sand and cement into gold must first learn how to make concrete. Block makers and cement workers generally are lamentably ignorant in this fundamental operation. The impression has gotten out that a laborer who is not fit for anything else can mix concrete, that the cheapest labor that one can employ is good enough to do this work. This part of the world is well saturated with this idea. The question of brains and the concrete mixer is rarely considered. Almost the only difficulty in the physical composition of cement blocks is in the making of concrete. With this understood and appreciated and thoroughly ingrained into the cement worker, his physical difficulties are well out of the way. The block maker, strange as it may appear, is the most difficult of all men to interest in the mixing of concrete. The architect who talks to the block maker is apt to meet a dull ear on this question. His auditor thinks that it is the other fellow. He will acknowledge that the rest of the regiment is out of step on concrete mixing, but that he is the one man who is in step.

Before we get through with our block business we are going to grade our sand, we are going to know that the voids are reduced to a minimum before the cement is introduced, and we will thoroughly mix the sand and the cement in the dry before the water is applied. Most cement workers believe that they are already doing this. Their wrong belief is the source of the physical trouble. It is the cocksureness of nearly all that is the real stumbling block. Block makers particularly have been educated by the machine salesman that any old thing can mix concrete. When we learn to mix concrete we can hope to make the impervious block. Cement makers, as a class, have done their work well and scientifically. They have availed themselves of all of the resources of science, and it appears absurd that this work should have stopped with the making of the cement. The chemist, the engineer and the cement maker have joined hands in the mixing of concrete. In the making of blocks they have parted company. We have been floundering around, doping our blocks or

letting the rain pour through them merely because we have not given the right kind of attention to a primary step in block making.

We may take lessons from the modern mechanical mortar maker in the mixing of the aggregate in concrete. He dries his sand and mixes it mechanically. The makers of bitulithic pavement have reduced the grading process to a science, and on that account are reaching a large measure of success. We may study a modern asphalt plant with profit.

Sand must be clean. Most cement blocks that I know anything about are made of dirty sand. All of them were of a muddy tone. If one would make a clear, crisp, life-colored block he must use clean, crisp, sharp, live sand. Barnyard mixtures make barnyard colors. Most of the blocks that we see are dull, heavy, lifeless and leaden in color and texture. This can be obviated by clean sand and a proper proportion of cement of the right kind. The oolitic stone that we use in our best buildings is almost absolutely pure in its ingredients. As we ride through the country and see the cement block buildings, with their dull, leaden color, we may trace it to dirty sand. We may do whatever we please with cement mixtures with respect to color and texture. We may make a white block if we will, but we must use white sand and white cement, and must handle it with clean hands and clean tools.

We will mix our aggregate with more water than has been common with must of us. We will experience troubles from crazing, hair-cracking, if we do not take advantage of our opportunities. The cause of this trouble from cracking suggests its own remedy. It is the relatively neat cement on the outside of the block, the difference between the composition of the surface of the block and the interior—a difference in contraction. If our blocks are of the right composition we may wash them and we may cover them with damp cloths while they are setting. We may rake them over with a fine-toothed tool. We may give them a texture with a white wire brush. The man of resource, keen perception and artistic insight will find many ways of getting around this difficulty.

The principle involving the production of proper texture is not difficult to understand when we analyze it. We want cement enough, certainly not too much. We know that we want it evenly distributed. The nearer we can come to exposing the sand on the surface, the nearer we can come to having the view side of the sand, the side that we see, free from cement, the better. Those of us who can remember the lost art of old-fashioned, hard-finished wall plaster know what this means. With a brush and mortar the plasterer washed out all superfluous lime, and up to a certain point the more lime he washed out the harder and stronger, brighter and crisper he got his plastering. This principle may be applied to the surfacing of cement blocks. In one way or another we shall wash out the neat cement. Unless the proportion of sand and cement be uniform, the texture will not be uniform. The best brick that are now made for decorative purposes, for facing, are not intensely smooth. They have a grain—a texture, we call it. The surface is gritty. It has somewhat of a sandpaper quality. It receives the light in a pleasing way. Ths is what we mean when we say that a surface of stone or brick has good texture.

I have merely hinted at the possibilities of color work in concrete. We have not yet reached the stage where it would be very profitable to go into this. When we know how to mix sand and use clean materials and mix the cement and water with it, when we know how to handle our blocks, when we know texture and uniformity, then may we consider color. It is sufficient to say that the liveliest imagination of the Arabian and the people of the Orient may find permanent record and adequate expression in the color, texture and substance of the cement block. We will have to get out of the backyard and shed stage of this industry, however, before we can take up cement polychrome.

The immediate task before us is to do the best with what we have, with the men and the brains that we have, with the sand and the cement that we have. The cement is adequate to our capacities for some time to come. We can afford to disturb ourselves a whole lot less about cement and a whole lot more about sand.

An influential cause for the feeling which architects have for the cement block is the difficulty of having their plan exactly carried out. There is too much cut-and-try business. The architect or the builder is not going to submit to compromises in one material that he does not have to submit to in others. In terra cotta, stone and brick all plans can be carried out to a nicety, and there are no advantages otherwise in the concrete block which will lead to a compromise in its favor. The setting plans of a stone cutter and a terra-cotta worker are marvels of neatness, exactness and accuracy. Great buildings are built practically without the sound of the hammer. Certainly the work is fitted before it leaves the cutting shop or the factory. There is no reason why this should not be done in

the same way by the block maker. It must be done or the block business will not succeed. I recently had an experience with a block maker who made a setting plan on a shingle and then lost the shingle.

Mechanically, the cement-block industry is in good shape. The work has been fostered and promoted very largely by machine makers. However, the industry has been injured by the machine salesman, who has minimized and at times concealed the difficulties in the way of making a commercial block. So far as the block itself is concerned, the machine is the least important factor in its manufacture. A cement block can be made in a wooden box. Any machine will make a block that is commercially satisfactory if the material is at hand to put into it, providing there is an opportunity for proper tamping or compression. The important part which the machine plays in this industry is in reducing the cost of the block. This work has been well done and little need be said about it here. It is well for the block maker to understand, however, that he must be able to so adjust his machine that a block of any size in any direction within fractions of an inch can be readily made on a commercial basis. The builder, the house owner, the investor can get what he wants in other materials, and he will not put up with compromises in the block.

The laying out of the work in the shop and the preparation of careful shop drawings will very largely eliminate the evil of indifferent handicraft, bad workmanship, and we all know that there is no branch of the building business that has suffered as much at the hands of the botch as the block industry.

Concrete, in its nature, suggests a comparison with stone. Hence the high standard. A part of beauty in a building is color, texture, general design, but after that there comes the question of detail, of the parts, the moldings, the ornament. On the one hand there is mere construction, mere building, and then there is art. In order to have architecture there must be both building and art. In architecture the two are inseparable. Its costs no more money to make a beautiful form than it does an ugly one. I would regard it as an opportunity lost if I did not say here and now in the strongest terms at my command that there is no excuse for an ugly structure of any kind in this world. Be it a building, a bridge, a bit of furniture, a machine or any other object in which material and labor are brought together, there is absolutely no excuse for ugliness on any account. There is no excuse for ugliness on the grounds of cost. Good proportion costs no more than bad proportion, harmony of color costs no more than inharmony; there is no more expense of material or labor in a well-formed molding than in an ugly one. There is no more expense attached to grace than to clumsiness. Beauty is a condition of mind, a condition of heart, of character, and not one of pocketbook. Clumsiness and crudeness come out of a crude and clumsy mind. It takes no more time or material and no more labor to cast a beautifully formed block than one ugly in form. I do not say that one form may not be more expensive to cast than another, but I do say that there is no excuse for casting an ugly one. Everything made by man might be beautiful without material consideration. There are certain standard forms that can be produced and reproduced as they have been for more than twenty-five hundred years. Their repetition has had no effect upon their beauty or appreciation by the public. The forms most commonly in use at this time by architects and artist builders date from the fifteenth and sixteenth centuries. It is from this source that the ornamental brick makers draw most of their inspiration. It will be necessary for you to employ artistic designers who can design for you certain relatively simple standard designs which may be readily adaptable for various purposes. This is eminently a practical thing to do, and it must and will be done if the block business reaches any large measure of commercial success. Hitherto he has been a great sinner in producing the crude and ugly shapes.

The cement-block machine is a great art democrat. It may produce and reproduce artistic forms for the masses. It may give us beautifully decorated structures at a minimum of cost. Art is not for the few any more than education is for the few. Art should be for everybody. Art should be democratic, and the block machine should be a great art democrat. There is an intimate relation between this idea and the bank account of the block maker.

There are those among you who will say that these expressions in regard to the making of concrete, the grading of sand, the cleaning or washing of sand, the fine adjustment of mixtures, the matters related to color, form and art are ideal. Possibly they are ideal. We progress through idealization. The cottage is a man's materialization of a state of mind which seeks something more than to keep out of the wet and cold. But for the idealization, we would not quarry or cut stone. We would not make brick.

CONCRETE AGGREGATES.

By Sanford E. Thompson, M. Am. Soc. C. E., Newton Highlands, Mass.

The term "aggregate" includes not only the stone, but also the sand which is mixed with cement to form either concrete or mortar; in other words, it is the entire inert mineral material. This definition, now generally accepted, has replaced the one restricting the term to the coarse aggregate alone.

It is the object of this paper to enumerate briefly the general principles which should be followed in the selection of sand and stone for mortar and concrete, and to briefly describe the method of testing aggregates and determining proportions which the author has found to give good results in practice.

At the outset it may be said that a concrete of fair quality, if rich enough in cement, can be made with nearly any kind of mineral aggregate, but there is nevertheless a wide variation in the results produced. For the fine aggregate, sand, broken stone screenings, pulverized slag, or the fine material from cinders may be used, separately, or in combination with each other. For the coarse aggregate, broken stone, gravel, screened gravel, slag, crushed lava, shells, broken brick, or mixtures of any of these may be employed. However, the very fact of the adaptability of concrete to so wide a range of materials—every one of which really consists of a large class varying in size, shape and composition—tends to blind one to the economies which often may be effected and the improvement in quality which almost always will result by a careful selection and proportioning of the aggregates.

In many cases, especially where the cost of Portland cement is low, it may be cheaper to use whatever materials are nearest at hand, and insure the quality of the concrete or mortar by making it excessively rich in cement. If the structure is small and of little importance, this course is properly followed, but, on the other hand, if a large amount of concrete is to be laid, and especially if the process is to be carried on in a factory—as in concrete block manufacture—it pays from the standpoints of both quality and economy to use great care in the selection of the aggregates as well as of the cement and to provide means for maintaining uniformity.

To illustrate the variation which different aggregates may produce even when they are mixed with cement in the same proportions, the author has selected a few comparative tests of mortar and concrete.

Effect of Different Aggregates Upon the Strength of Mortar and Concrete.—Tests made by Mr. Rene Feret*, of France, with mortar made from different natural sands show a surprising variation in strength, which is evidently due simply to the fineness of the sand of which the different speciments are composed. Selecting from his results proportions 1:2.5 by weight, that is, one part cement to 2½ parts sand, and converting his results at the age of five months, from French units to pounds per square inch, the average tensile strength of Portland cement mortar made with coarse sand is 421 pounds per square inch, with medium sand 368 pounds per square inch, and with fine sand 302 pounds per square inch. In the crushing strength, usually the most important consideration, the difference is even more marked. In round numbers, at the age of five months, the mortar of coarse sand gave 5,000 pounds per square inch, the medium sand 3,400 pounds per square inch, and the fine sand 1,900 pounds per square inch. Note that the different sands were not artificially prepared, but were taken from the natural bank, and correspond to those which every day are being used for concrete and mortar.

The effect of different mixtures of the same kind of material is shown by tests with which the author has been connected during the past year, but the results of which have not yet been published. By varying the sizes of the particles of the aggregates, but using in all cases stone from the same ledge and the same proportion of cement to total agregate by weight, namely 1:9 (or approximately 1:3:6), he found it possible to make specimens the resulting strengths of some of which were 2½ times the strengths of others.

The effect of the hardness or strength of the stone used for the coarse aggregate is shown in tests by George W. Rafter,† which, for proportions, about 1:2:6.5, gave 50 per cent. greater compressive strength of concrete where the coarse aggregate was a hard sandstone than, with similar proportions, where a shale was substituted. In some of his tests the harder stone gave a concrete

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*See Taylor and Thompson's "Concrete, Plain and Reinforced, 1905, p. 136.

†Second Report on Genesee River Storage Project, 1894.

even double the strength of the concrete with the softer stone.

General Principles for Selecting Stone.—The quality of concrete is affected by the hardness of the stone; the shape of the particles; the maximum size of the particles, and the relative sizes of the particles.

If broken stone is used, and there is an opportunity for choice, the best is that which is hard, with cubical fracture, with particles whose maximum size is as large as can be handled in the work, with the particles smaller than, say, one-fourth inch screened out (to be used as sand), and with the sizes of the remaining coarse stone varying from small to large, the coarsest predominating.

If gravel is used, it must be clean; the maximum size of particles should be as large as can be handled in the work; grains below, say, one-fourth inch should be screened out (to be used as sand), and the size of the stones should vary, with the coarsest predominating.

I have said that the size of the coarsest particles of stone should be as large as can be handled in the work. This is because the strength of the concrete is thereby increased, and a leaner mixture can be used than with small stone. In mass concrete the stones, if too large, are liable to separate from the mortar unless placed by hand or derrick, as in rubble concrete, and a practical maximum size is 2½ or 3 inches. In thin walls, floors and other reinforced construction, a 1-inch maximum size is generally as large as can be easily worked between the steel. In some cases where the walls are very thin, say, 3 or 4 inches, a ¾-inch maximum size is more convenient to handle.

It is a little more trouble, but almost always best, to screen out the sand from gravel, or the fine material from crusher stone, and then remix it in the proportions required by the specifications, for, otherwise, the proportions will vary at different points, and one must use, and pay for, an excess of cement to balance the lack of uniformity.

If gravel is used, it is absolutely essential that it shall be clean, because if clay or loam adheres to the particles, the adhesion of the cement will be destroyed or weakened. Tests of the Boston Transit Commission* gave an average unit transverse strength of 606 pounds per square inch for concrete made with clean gravel as against 446 pounds per square inch when made with dirty gravel.

Comparative Values of Different Stone.—Different stones of the same class vary so widely in texture and strength that it is impossible to give their exact comparative values for concrete. A comparison by the author of a large number of tests of concrete made with different kinds of stone indicates that the value of a broken stone for concrete is largely governed by the actual strength of the stone itself, the hardest stone producing the strongest concrete. This forms a valuable guide for comparing different stones. Comparative tests indicate that different stones for concrete in order of their value are approximately as follows: (1) trap, (2) granite, (3) gravel, (4) marble, (5) limestone, (6) slag, (7) sandstone, (8) slate, (9) shale, (10) cinders. Although, as stated above, the wide differences in the quality of the stone of any class make accurate comparisons impossible—and this difficulty is increased by the fact that the proportions and age of the specimens affect their relative value—an approximate estimate drawn from actual tests, gives the value for concrete of good quality sandstone as not more than three-fourths the value of trap, and the value of slate as less than half that of trap. Good cinders nearly equal slate and shale in the strength of concrete made with them.

The hardness of the stone grows in importance with the age of the concrete. Thus gravel concrete, because of the rounded surfaces, at the age of one month may be weaker than a concrete made with comparatively soft broken stone, but at the age of one year it may surpass in strength the broken stone concrete because, as the cement becomes hard, there is greater tendency for the stones themselves to shear through, and the hardness of the gravel stones thus comes into play. Gravel makes a dense mixture, and if much cheaper than broken stone can usually be substituted for it.

A flat grained material packs less closely and generally is inferior to stone of cubical fracture.

General Principles for selecting Sand.—The only characteristics of sand which need be considered are the coarseness and relative coarseness of its grains and its cleanness. These qualities affect the density of the mortar produced, and therefore the test of the volume of mortar, or "yield," determines which of two or more sands is best graded. The "yield" or "volumetric" test I consider of greater value for quick results than all others put together. The methods of employing it are described farther along in the paper.

The best sand is that which produces the smallest volume of plastic mortar when mixed with cement in the required proportion by weight.

A high weight of sand and a corre-

*Seventh Report of Boston Transit Commission, 1901, p. 39.

sponding low per cent of voids are indications of coarseness and good grading of particles; but because of the impossiblity of establishing uniformity in weighing or measuring, they are merely general guides which cannot under any conditions be taken as positive indications of true relative values. The various characteristics of sands are separately considered in the following paragraphs:

Weight of Sand.—A heavy sand is generally denser, and, therefore, better than a light sand. However, this is not a positive sign of worth, because the difference in moisture may affect the weight by 20 per cent., and when weighed dry the results are not comparable for mortars, since a fine sand takes more water than coarse.

As an illustration of the variation in weight of natural sands having different moisture, the author found that the weight per cubic foot of Cowe Bay sand, which, dry, averaged 103 pounds, when placed out of doors, and weighed after a rain in exactly the same way (although it was allowed to drain for two days), averaged 83 pounds.

Voids in Sand.—The voids, like the weight, are so variable in the same sand, because of different percentages of moisture and different methods of handling, that their determination is of but slight value. In the Cowe Bay sand just mentioned, the voids were 38 per cent. in the sand, dry, and 52 per cent. in the same sand, moist.

Because of such discrepancies the author prefers to mix the sand with the cement and water, and determine the voids in the fresh mortar, as described later. This gives a true comparison of different sands, since with the same percentage of cement the mortar having the lowest air plus water voids is the strongest.

Coarseness of Sand.—A coarse sand produces the densest, and, therefore, the strongest, mortar or concrete. A sufficient quantity of fine grains is valuable to grade down and reduce the size of the voids, but in ordinary natural material, either sand or screenings, there will be found sufficient fine material for ordinary proportions, such as 1:1, 1:2, or 1:2½. For leaner proportions, such as 1:4 or 1:5, and sometimes 1:3, an addition of fine particles will be found advantageous to assist the cement in filling the voids. A dirty sand, that is, one containing fine clay or other mineral matter, up to, say, 10 per cent., is actually found by tests to be better than a clean sand for lean mortars.

For water-tight work it is probable that a larger proportion of very fine grains may be employed than for the best results in strength. This is a question, however, which has not yet been thoroughly investigated.

Feret's rule for sand to produce the densest mortar is to proportion the coarse grains as double the fine, including the cement, with no grains of intermediate size. There is difficulty in an exact practical application of this rule, but it indicates the trend to be followed in seeking maximum density and strength.

Cleanness of Sand.—An excess of fine material or dirt, as has just been noted, weakens a mortar which is rich in cement. It may also seriously retard its setting. My attention was recently called to a concrete lining, one portion of which failed to set hard for several weeks, although the same cement was used as on adjacent portions of the work. The difficulty proved to be due entirely to the fact that the contractor substituted in this place a very fine sand, the regular material happening to run low.

Sharpness of Sand.—Notice that the quality of sharpness has not been mentioned among the essential characteristics of sand. This omission was intentional. The majority of specifications still call for "sharp" sand, and yet I have never known—and I venture to predict that none of those present have ever known—a sand to be rejected simply because of its lack of sharpness. As a matter of fact, if two sands have the same sized grains, and contain an equal amount of dust, the one with rounded grains is apt to give a denser and stronger mortar than the sharp grained sand. A sand with a sharp "feel" is preferable to another, not to any extent because of its sharpness, but because the grittiness indicates a silicious sand, which is apt to have no excess of fine material.

Sand vs. Broken Stone Screenings.—Many comparative tests of sand and screenings have been made with contrary results. While frequently crusher screenings produce stronger mortar than ordinary sand, the author in an extensive series of tests has found the reverse to be true. This disagreement is probably due to the grading of the particles, although in certain cases the screenings may add to the strength because of hydraulicity of the dust when mixed with cement.

Testing Sand.—In the previous paragraphs are shown the defects in the more common methods of examining sand.

I now venture to propose a test for sand which I am using constantly in my experiments for clients. Tests which I made in 1903 proved to me the value of the principles of density of mortars laid down by Feret, and in the winter of that year similar plans for testing aggregates were introduced by Mr. William B. Ful-

ler and myself at Jerome Park Reservoir, New York City. The object of the test is to determine which of two or more sands will produce the denser, and therefore the stronger, mortar, in any given proportions. From the results of test, the relative strengths of two different mortars can be approximately estimated without resorting to actual tensile or compressive tests.

In opening this paper I have given the different results in strength which Mr. Feret found with coarse, medium and fine sands respectively, these relative strengths in compression being, respectively, 5,200, 3,400 and 1,900 pounds, with proportions 1:2½ by weight in each case. An examination of the tests shows that the strongest mortar was produced with a given weight of aggregate.

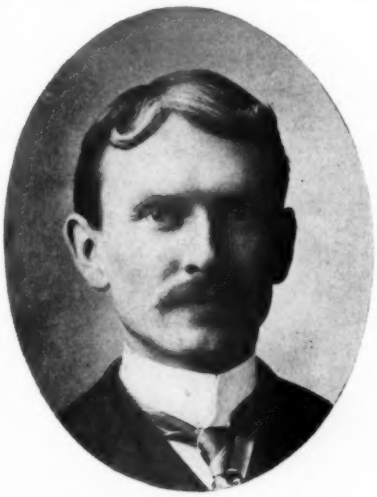
The mortar with medium sand occupied a volume 7½ per cent. in excess of the volume of the mortar with coarse sand, and the mortar of fine sand, a volume 17 per cent. in excess of the mortar with coarse sand.

Following these principles, two sands may be compared and the better one selected by determining which produces the smallest volume of mortar with the given proportions by weight.

Using the method described below, the author has been able to increase the strength of a mortar about 40 per cent. by merely changing the sizes of grains of the aggregate.

The method of making the test is as follows: If the proportions of the cement to sand are by volume, they must be reduced to weight proportions; for example, if a sand weights 83 pounds per cubic foot moist, and the moisture found by drying a small sample of it at 212 degrees Fahr. is 4 per cent, which corresponds to about 3 pounds in the cubic foot, the weight of dry sand in the cubic foot will be 83 minus 3 equals 80. If the proportions by volume are 1:3, that is, 1 cubic foot dry cement to 3 cubic feet of moist sand, and if we assume the weight of the cement as 100 pounds per cubic foot, the proportions by weight will be 100 pounds cement to 3 times 80, which equals 240 pounds sand, which corresponds to proportions 1:2.4 by weight.

A convenient measure for the mortar is a glass graduate, about 1½ inches diameter, graduated to 250 cubic centimeters. A convenient weight of cement, plus sand, for a test is 350 grams. For weighing I employed Harvard trip scales, which weigh with fair accuracy to one-tenth of a gram. The sand is dried and mixed with cement in the calculated proportions in a shallow pan about 10 inches diameter and 1 inch deep. The mixing is conveniently done with a 4-inch pointing trowel. The dry mixed material is formed into a circle, as in mixing cement for briquets, and sufficient water added to make a mortar of plastic consistency similar to that used in laying brick masonry. After mixing five minutes the mortar is introduced about 20 c. c. at a time into the graduate, and, to expel any air bubbles, is lightly tamped with a round stick, with a flat end. The mortar is allowed to settle in the graduate for one or two hours, until the level becomes constant, when the surplus water is poured off, and the volume of the mortar in cubic centimeters is read. For greater exactness a correction may be introduced for mortar remaining on pan and trowel. The other



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sands which are to be compared with this one are than mixed with cement in the 'same proportions by dry weight, and sufficient water added to give the same consistency. The percentage of water requireu will vary with the different aggregates, the finer sand requiring the more water. After testing all the mortars, the sand which produces the strongest mortar is immediately located as that in the mortar of the lowest volume. By systematic trials, the best mixture of two or more sands may also be found.

In some cases a correction must be introduced for the specific gravity of the sand; for example, ordinary bank sand has an average specific gravity of 2.65, but if this is to be compared with broken stone screenings having a specific gravity of, say, 2.80, the proportions of the two must be made slightly different. For these particular specific gravities, pro-

portions 1:3, by weight, with sand, correspond in absolute volume to proportions 1:3.2, by weight, of the screenings.

In making these tests, it is also important to notice the character of the mortar as it is being mixed. It should work smooth under the trowel and be practically free from air bubbles.

Calculating Relative Strength of Mortars.—From the results of the tests described, it is possible to very closely estimate the relative strength of different mortars made with the same cement. A formula is given by Mr. Feret* for calculating the strength from the absolute volumes of the ingredients of the mortar, but wishing to avoid the calculation of the absolute volumes and obtain the results directly from the weights of the materials and the volume of the mortar made from them, I have found it possible to evolve from Feret's formula one which makes use only of the data from the tests in the graduates above described. The formula is as follows: Call

P—compressive strength of mortar in pounds per square inch.
K—a constant.
Q—measured volume or quantity of mortar in cubic centimeters.
C—weight of cement used in grams.
S—weight of sand used in grams.
gc—specific gravity of cement.
gs—specific gravity of sand.

Then,

$$P=K\left(\frac{g_s}{g_c}\right)^2\left(\frac{C}{g_s\,Q-S}\right)^2$$

This formula may be readily altered to apply entirely to the English system of weights and measures.

The value of K varies with different cements and different ages of the same mortar, hence it is simplest to disregard the actual strength, and consider the relative strengths of any two or more mortars as in direct proportion to the values of the square of the quantities in brackets.

If the aggregates to be compared have similar specific gravity, as is the case with different natural sands, the relative strengths of the mortars will be in proportion to the values of

$$\left(\frac{C}{G_s\,Q-S}\right)^2$$

*See Taylor and Thompson's "Concrete, Plain and Reinforced," 1905, p. 139.

To illustrate the practical value of the formula, aside from theory, it may be of interest to refer to a recent series of comparative tests made in my own laboratory. A mixture of sand and cement in proportions 70 grams cement to 276 grams sand produced in a graduate a volume of mortar of 178 c. c. After making a number of trial tests, using in every case the same proportions by weight, a new mixture of sizes of the same aggregate was obtained, whose volume, when mixed with the cement and water, was 165 c. c. The specific gravity of the sand, which in this instance was crushed rock, in both cases was 2.88. Substituting these values in the formula, we find the ratio of the two tests to be 1 to 1.40, that is, the mortar having the smallest volume ought to be 1.40 times (or 40 per cent.) stronger than the other. Actual tests of the two mortars afterward made in similar proportions into long prisms, gave at the end of fourteen days an average of 832 pounds per square inch for one and 1,153 pounds per square inch for the other, thus showing an actual excess of strength of 39 per cent., which is substantially identical with the estimated increase.

Testing Concrete Aggregates.—For concrete in any given proportions, the best sizes of stone and of sand may be determined by similar methods to those described for testing sand mortars, although larger quantities of materials must be used and the measure must be strong enough to withstand the light ramming which is necessary. A short length of cast iron pipe, closed at one end, may be used for this.

The aggregates which mixed with cement in the required proportions produce the smallest volume of concrete are usually the best, although, as already indicated, the shape of the particles and their hardness must also be taken into consideration.

Proportioning Concrete.—Lack of time forbids the description of the application of these methods to determining the relative proportions of two or more aggregates in a concrete. Here again we have the general principle that the weight of material and the percentage of cement remaining the same, the mixture producing the smallest volume of concrete is the best.

THE SELECTION OF PORTLAND CEMENT FOR CONCRETE BLOCKS.

By Richard K. Meade, Chem. Eng., Nazareth, Pa.

In every new industry there are some successes and many failures. The concrete block industry has been more fortunate than most new industries, in that a heavy demand for building materials of all kinds has made the number of failures less than the number of successes. Whether this condition will last will depend entirely upon the class of work done by the present generation of concrete block manufacturers. If their work is good, if their product proves sightly and buildings made of it turn out to be enduring and sanitary, the failures of the future will be few, and will depend wholly upon a disregard of the law of supply and demand, or an ignorance of the business. If the work of the present generation is poor, if buildings built of its product are unsightly, damp and given to decay and ruin, the failures of the future will be many and will, of course, be directly attributable to the poor work of the present day manufacturers.

A general impression seems to prevail that sand is of many grades and must be carefully selected to give a block of good color and the requisite strength. Likewise, that each make of concrete block machine possesses features peculiar to itself which will add to the economy with which the factory can be run or the quality of its output. Portland cement, however, is thought to be Portland cement, and, like Caesar's wife, to be beyond reproach. One brand is often considered as good as the other, and the whole matter of selection often turns on a difference in price of a few cents a barrel. A sales agent for a large cement plant recently said to me, "My friend, there is no such a thing as *bad* Portland cement," which was another way of saying that "there is a sucker born every minute," and, if a cement is not good enough for the careful purchaser who tests his purchase, it can readily be worked off on the careless man who does not.

The concrete block manufacturer needs the best of cement, and the future of his business will depend upon his getting this. If he allows his warehouse to become the dumping ground for cement rejected for such heavy rough undertakings as piers, abutments, foundations, etc., how can he expect the finer and more exacting class of work which he does to last?

It is the purpose of this paper to point out the properties most requisite in Portland cement to be used for the manufacture of concrete blocks. Three all-important qualities of the latter will be dependent upon the cement of which they are made—two of them will be entirely dependent upon it and the third to some extent. These properties are:

(1) Endurance.
(2) Strength.
(3) Color.

The endurance of the block is, of course, an important property, as it makes little difference what strength the building may have when made if in short time it is to disintegrate. The strength of the block, however, should be such that it will withstand all stresses, strains and loads which may be applied to it, either in the laying of it in the wall or after it is in position and the building completed. The color of the block affects its marketability for superstructure work.

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To take up the way of attaining these qualities in detail, we will first turn our attention to endurance.

To manufacture concrete blocks which will last, and which will retain their strength in spite of the disintegrating action of time, water and the gases of the atmosphere, a "volume constant" or "sound" Portland cement must be used.

What causes certain cements to swell and expand after mixing with water and allowing them to harden is not certainly known. Those conditions surrounding the manufacture of cement which give it this tendency are well understood, however, and are usually improper proportioning of the raw material (allowing the lime to be in excess over the silica and alumina) and insufficient grinding and burning of the mixture. This has led most cement investigators to attribute disintegration to an excess of "free lime." This free lime is locked up in a case of hard cement clinker, and is almost as effectually protected from water when the cement is made into concrete as if it were sealed up in a bottle. In time, however, the hard protecting case of clinker is itself acted upon by the moisture of the atmosphere, etc., and becomes hydrated. The water then has a chance to get at the free or loosely combined lime, and this, in hydrating or combining with the water, expands with great force and disintegrates the now fully hardened concrete, just as water freezing in an enclosed vessel will burst the container, no matter what its strength may be. This is the most common explanation of the "blowing" or expanding of unsound cement, but be the reason what it may, it is a fact that such Portland cement sometimes expands to such an extent after hardening that the expansion may even be measured and blocks of concrete made from such cement will sooner or later fall to pieces and disintegrate.

Certain brands are much more liable to this tendency than others. Some mills are provided with insufficient grinding machinery for the raw materials, and can, therefore, seldom make a cement which is sound when fresh. These depend on seasoning to make their product sound, and hence, when pushed for orders, are very apt to ship fresh, and consequently, for them, unsound cement. Lack of knowledge, or of skill in manufacture, or of system in supervising the process, often are the causes of unsound cement. It is probably easier to make a sound cement from cement rock alone than from any other material, and next to this comes the cement-rock-limestone mixture, the difficulty with this growing as the percentage of limestone in the mixture increases. It usually costs less to make an unsound cement than a sound one, because less care is needed in proportioning the raw materials, less grinding is necessary to prepare them for the kilns and less coal may be employed in burning them. Consequently, the block manufacturer should exercise care in purchasing cement to make sure he does not secure cheaply or carelessly made and, consequently, often unsound cement. If he does secure such a cement, the result will be this: his blocks when freshly made and after "curing" will be sound and hard, and will present no sign of the dissolution, which may ultimately take place with them. They will go out and be laid in the wall of a house. In time, possibly in a year, maybe more, the face of the blocks will begin to crumble and strip off the blocks, cracks will appear in them, and, if the cement was very much unsound, the blocks will eventually crumble away.

Unsound cement is by no means a rare occurrence, either, and there are manufacturers who believe "no cement is bad" and ship fresh, whether it passes standard "soundness" test or not. The cement inspector of a large corporation recently told me that 90 per cent. of the cement offered his concern by a certain manufacturer was rejected because of its failure to pass the soundness tests. Are you certain that you did not get any of this cement? I know that cement tests are expensive, yet I know of no better safeguard against unsound cement than the laboratory test. The next best thing is confidence in the knowledge, skill, care and good faith of the manufacturer himself. The concrete blocks made of unsound cement differ in no way perceptible to the senses from those made of sound. It may not disingrate for years; it may, indeed, for that matter, never disintegrate, but the chances are that the blocks made of unsound cement will sooner or later crack and crumble, and the concrete block industry in the sections in which this does occur will very likely receive a serious setback thereby.

It is now generally recognized that seasoned cement is much better than fresh. My own experiments indicate that cement seasoned in bulk for about six months is at its best. Cement which has been kept in bags this length of time, unless stored in a very dry place, may lump, however, and consequently the block manufacturer may have some trouble making a good sand mixture. There is much to be said in favor of the block manufacturer buying his cement in large quantities and storing the same for some months. By doing this he will be much less likely to use unsound cement, since unsound cement is often cured or made sound by seasoning. The cement will also gain some in strength. Two objections to storage are, the liability of the cement to lump or cake, and possibly in some cases of its becoming quick setting. The latter tendency is usually met with in low limed and poorly manufactured cements, though under certain conditions all cements seem liable to become quicker setting with seasoning.

It is a well known fact to those versed

in the technology of Portland cement that the addition of plaster of Paris to unsound cement often makes it pass the standard steam test; and that some manufacturers make a practice of so "doctoring" unsound cement. The addition however, is harmful to cement, as an excess of plaster not only causes the concrete to weaken in time, but also causes unsightly white streaks and efflorescence on concrete blocks. The unsoundness caused by plaster can only be detected by long time tests, so that the usual plan of guarding against it is by limiting the amount of sulphur trioxide found in the cement to 1.75 per cent. Since this is the active constituent in plaster of Paris, by determining the amount present (as can readily be done by a chemical analysis), we can calculate if a harmful percentage of plaster has been added to the cement.

While not strictly falling under the title of this paper, it may be well here to mention some causes of unsoundness in concrete blocks, which are not due to the quality of the Portland cement itself, but to qualities which are developed in it by the use of certain chemicals, etc., added to facilitate manufacture or give color. The demand for a quick setting cement has brought into use the carbonates and hydroxides of potash and soda. These chemicals are the base of nearly all the quick hardeners sold to the concrete block manufacturer. They cause unsoundness to a marked degree, and should not be used except upon the advise of an expert cement chemist. They also cause efflorescence on the block.

Some care should also be used to guard against coloring matters for the blocks which contain chemicals, such as the sulphides or sulphates, chromates, acetates, etc., likely to react with the cement to the damage of the block. Most sulphides are readily oxidized to sulphates, which change is accompanied by expansion and consequently disintegration of the block. Pure oxide colors are best, and can be used with safety. Sands with a large percentage of soda and potash minerals (such as mica) or containing pyrites (iron sulphide) are also objectionable for the reasons given above.

The strength which Portland cement may develop is due to various conditions of its manufacture, such as chemical composition, thoroughness of burning, and fineness to which it is ground. As cement is always used with sand, no attention need be paid to its neat strength unless blocks are to be faced with very rich mixtures. Neat strength is very deceptive and is seldom a reliable indication of sand strength.

One of the most important qualities of Portland cement in determining the strength of the concrete made from it is the fineness to which it is ground. Other things being equal, the finer the cement, the greater will be the strength of the concrete. Thus, a cement as ground by the manufacturer so that 95 per cent. of it would pass a 100 mesh sieve, gave a sand tensile strength of 267 pounds in seven days, while the same cement ground to all pass a 200 mesh sieve gave 375 pounds for the same period, or an increase of 40 per cent., in sand strength due to finer grinding.

Probably all concrete block manufacturers are striving for a waterproof block —one in which all the voids are filled. This latter may be achieved by the use of a richer mixture, by waterproofing compounds, or preferably by the employment of a sand containing the proper proportion of fine particles. These fine particles help to fill the interstices between the coarse ones and to so keep out the water. One of the oldest principles of good concrete is "to coat the particles of sand with the cement paste," and that the strength of the concrete is proportionate to the thoroughness with which this has been done. Now, the finer a body is pulverized, the more surface it will present. Thus, if we divide a cube an inch square into halves, we will increase the surface area from 6 to 8 square inches, and if we quarter it we will increase to 10 square inches, etc. Consequently, the finer the sand we use, the more surface there will be to coat and for exactly the same reason the finer must be the cement be to coat this sand.

By using a sand containing fine particles and a finely ground cement in place of a richer mixture, fine cement is made directly more economical than the coarsely ground one.

By "fine cement" however, is not meant a cement ground by rolls, etc., to show a good sieve test, but a cement which contains a large percentage of flour. Since in such a dense concrete there are no voids, or practically none, there is no room left for the expansion of the cement during heardening, as is the case with ordinary porous concrete where the cement can usually expand a little into the spaces between the sand grains, and it is doubly important to use a sound, or, in other words, a non-expanding Portland cement.

The setting time of Portland cement also has an important influence on the strength. Slow setting cements, that is, cements which get their final set in from 4 to 9 hours, are much stronger than those which set more quickly. Quick setting cements are nearly always overclayed, and contain less of the active silicate and aluminate of lime, to which ce-

ment owes its strength, than the slower setting ones. This may seem paradoxical, but is nevertheless true. The compounds in cement which set quickly are not those which give it great strength, consequently cements giving an initial set of less than 30 minutes are hardly ever as strong as those which require 2 or 3 hours. For example, a cement which sets in 30 minutes rarely ever, unless very finely ground, gives a 7-day sand test of over 250 pounds, while one with a set of 2 or 3 hours may easily give 300 to 350 pounds, or even more. Cements with a "flash" set, that is, which set up under the trowel, should not be used in making blocks, as these latter are apt to be weak. With such cements the set is broken by working, the processes of solution and crystallization are interfered with, and consequently have only half a chance to do their work. The set of the cement should always be sufficient to give ample time to mix the mortar and fill the machine, or molds.

One of the greatest requisites of Portland cement to be used for concrete blocks is that it shall be a quick hardener. It must get its strength promptly. By prompt hardening is not meant quick setting cement. The term "set" is merely used to define the change undergone by the mortar in passing from the plastic to the solid state. The hardening only begins after the setting process is completed, and quick setting cements are not necessarily prompt hardeners, and are, indeed, usually the reverse.

The best test for prompt hardening is the 7-day sand strength. Cements which get a tensile strength of 300-350 pounds per square inch in 7 days are now on the market, and these are best suited to concrete block manufacture. If the blocks do not lose strength, the sooner they get their full strength the better, because the sooner they can be used, as less time is needed to cure them. A cement which has a sand strength of 350 pounds after 7 days, and which has only increased 50 pounds in a year, is, to my mind, much better for the purpose than one which has a strength of 200 pounds at 7 days and increased 150 pounds in the same length of time; because it will stand the same stress seven days after making that the other one will after it is a year old. A building may have to bear its full load three months after the blocks are made, and hence the prompter hardening cements are needed for block making.

Concrete blocks are now sometimes waterproofed by coating their exposed surface with a thin layer of paraffine. This thin layer effectually protects the interior of the block from the moisture of the air and as cement cannot gain in strength after it is so coated, consequently, where waterproof blocks are made, prompt hardening cements should be used, and the block should be allowed to gain good strength before applying the coating. For a similar reason these blocks should not be made too dry.

The concrete block manufacturer will probably be more interested in the color of his blocks than in any other one of their properties, since upon this will depend the immediate marketing of his product. Uniformity of color is, therefore, very important to him, since the color of a building, in order to be pleasing, should present a uniform appearance to the eye. Uniformity can only be secured by making the block of uniform cement and sand mixed in definite proportions and manufactured into blocks under as nearly the same conditions as it is possible to obtain. For coloring blocks, dark colored cements may be used but their color should be uniform. For lighter blocks, light colored cements must be used. As the color of cement gets lighter as it is ground finer, only finely ground cements should be employed for this work. The percentage of iron and manganese in the cement also influences the color. Cements free from iron and manganese would be white, and the color darkens as the percentage of iron or manganese increases. Most cements are practically free from manganese, and hence the color is usually due to iron.

Sulphate of lime, which is always added to cement to regulate the set, is one of the causes of the white efflorescence seen on concrete blocks. This salt is soluble and is carried to the surface of the block by the water which "sweats" out during curing. The less sulphate of lime present in cement intended for concrete block manufacture, the better. As Portland cement can be obtained which contains less than 1.5 per cent. sulphuric trioxide (the chief constituent of the sulphates and the way they are usually reported in a chemical analysis), it is hard to see why cement containing more than this amount should be used.

The alkalies are also soluble salts, and are to some extent responsible for the saline efflorescence on concrete. Cements low in these should, therefore, be used. Most American Portland cements, however, contain less than 1 per cent. alkalies.

Sulphide of iron is sometimes met with in cements burned in upright kilns. This causes dirty brown splotches to appear in the work from the oxidation of the iron to brown oxide of iron or "rust." Overclayed cements also show the same dirty brown color throughout the mass, as in such cements the iron seems to be present as the red brown "sesquioxide" instead of the black "magnetic" oxide of well made cements.

THE SECOND CONVENTION OF THE NATIONAL ASSOCIATION OF CEMENT USERS.

The second convention of the National Association of Cement Users was called to order by President Richard L. Humphrey in the West Side Turner's Hall, Milwaukee, Wis., at 3 p. m., January 9, 1906. All the business matters were set for the afternoon session of the next day, and the program of papers was begun by the reading of Sanford E. Thompson's paper on "Concrete Aggregates," which is printed on another page. In the discussion, Mr. Cummings stated that he had made water-tight concrete of a 1:3:7 mixture by a perfect balancing of the aggregates, 1:2:4 being the usual proportions assumed for water-tight concrete. He also called attention to the necessity of getting all the air out of the concrete, which is perhaps easiest done by making the concrete very wet. The question of clean sand having been raised, several persons were called upon for statements, and, while all admitted the apparent increase in strength of mortars containing small proportions of clay, nearly all preferred clean sand, well graded. The difficulty of finding the clay well pulverized and thoroughly mixed with the sand and gravel was clearly shown. Limestone dust was preferred by some to the clay, and while one or two had used hydrated lime successfully as fine material in the mixture, it was objected to by others on the ground of cost and of possible defective hydration.

The effect of grading sand by sifting into fine and coarse and gravel, and proportioning, say, 1 cement, 1 fine sand, 2 coarse sand and 3 gravel, was shown by one speaker to result in a much denser block than the use of 1 of cement to 3 of common bank sand.

George W. Stanley's paper on sidewalk construction was then read by the author. He called attention to the necessity of thorough drainage, and gave the results of some experiments on the use of salt in preventing freezing of walks laid in cold weather. He spreads the salt with the cement so as to mix salt, cement and sand in one operation. The walk is covered with sawdust or earth and canvas during hardening. About 10 per cent. more cement is required in cold weather. Following is the laboratory report of tests on briquettes molded, part with fresh water and part with the addition of about 15 per cent of salt to the water used in mixing the concrete:

Memorandum of cubes broken at Case School, A. S., by A. G. Anthony and E. E. Pheneger, class 1906. Condition of sand and gravel, moist; amount of water used, about 18 per cent.; per cent. of salt to water, about 15. Molded December, 1904, by Geo. L. Stanley, Ashtabula, O. Broken December 15th, 1905:

Initial marks, S. O.
Inside and hard set, temperature, 10 degrees. Remainder of year in open air uncovered.
Top coat, 3 cement, 5 sand; bottom coat, 1 cement, 5 gravel.
Compare with S. O. I. to show effect of salt on concrete.
Ultimate strength in pounds salt water, 8,600, 10,000, 12,000, 15,000.
Mean average salt water, 11,150.

Initial marks, S. O. I.
Inside and hard set in dry basement, temperature 40 degrees. Remainder of year covered in moist cellar.
Top coat, 3 cement, 5 sand; bottom coat, 1 cement, 5 gravel.
Made from the same brand of cement and molded the same as S. O.
Ultimate strength in pounds salt water, 9,000, 11,400, 14,000, 10,600, 13,200.
Mean average salt water, 11,640.
Four hundred and ninety pounds in favor of moist cellar.

Initial marks, S. A. O.
Inside and hard set in air about 10 degrees temperature. Remainder of year outside air, uncovered.
Top coat, 3 cement, 5 sand; bottom coat, 1 cement, 5 gravel.
Compare with S. A. I. to show the effect of salt on concrete.
Ultimate strength in pounds salt water, 18,000, 16,800, 19,000, 17,400, 19,000.
Mean average salt water, 18,040.

Initial marks, S. A. I.
Inside and hard set in basement. Remainder of year in cellar, uncovered.
Top coat, 3 cement, 5 sand; bottom coat, 1 cement, 5 gravel.
Same brand cement and molded like S. A. O.
Ultimate strength in pounds salt water, 20,000, 13,000, 13,400, 16,400, 11,200.
Mean average salt water, 14,800.
Three thousand two hundred and forty pounds in favor of outside air.

Initial marks, F. A. O.
Inside and hard set, temperature about 10 degrees. Remainder of year outside air.
Top coat, 3 cement, 5 sand; bottom coat, 1 cement, 5 gravel.
Ultimate strength in pounds fresh water, 7,000, 10,000, 7,800, 9,600.
Mean average fresh water, 8,600.
Compare with F. A. I. to show injury by freezing before initial setting.

Initial marks, F. A. I.
Inside and hard set in basement. Remainder of year in cellar, uncovered.
Top coat, 3 cement, 5 sand; bottom coat, 1 cement, 5 gravel.
Ultimate strength in pounds fresh water, 13,000, 14,000, 12,000, 19,000.
Mean average fresh water, 14,500.
Same brand cement and molded like F. A. O.
Compare S. A. O. and F. A. O. to show benefits from using salt in water used to mix concrete.
Salt water over fresh, 9,440.

Initial marks, E. G.
Inside and hard set in basement. Remainder of year covered in cellar.
Top coat, 3 cement, 5 sand.
Ultimate strength in pounds fresh water, 31,800, 25,800, 24,600, 20,600.
Mean average fresh water, 25,700.

Initial marks, E. O.
Inside and hard set in basement. Remainder of year in outside air.
Top coat, 3 cement, 5 sand.
Ultimate strength in pounds fresh water, 21,100, 30,000, 18,000, 30,000.
Mean average fresh water, 24,750.
Comparison of E. G. and E. O. shows practically the same strength of concrete as a whole.

The discussion brought out the fact that there is efflorescence on the surface of a block made with salt water, this efflorescence not being objectionable on a side-

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walk block, as it is quickly worn off, but being more serious in a block for a wall.

At the evening session, President Richard L. Humphrey delivered his annual address, and A. L. Johnson discussed "Steel for Reinforcement," both of which were illustrated with stereopticon and are printed elsewhere in this number.

At the morning session of Wednesday, C. A. P. Turner read his paper on "Cement and Building Construction," which was quite thoroughly discussed by Mr. T. L. Condron and others, bringing out details corroborating the general conclusions of the paper, showing that test loads are often three times the computed regular maximum load, calling attention to the differences between plain and deformed bars, and to the large number of formulæ for strength of reinforced concrete beams and slabs, many of which are given in MUNICIPAL ENGINEERING, vol. xxix, p. 347.

Mr. R. W. Lesley delivered an address on "The Relation of the Cement Manufacturer to the Cement User," in which he called attention to the rapid disappearance of lumber and the necessary substitution of cement therefor. He praised the good work of the early users of cement at $5 a barrel and traced the vicissitudes of cement through periods of bad work and high prices, to the time of acceptance of American Portland cement as standard in quality, and thence through the reductions in cost of manufacture. He touched upon the devedopment of reinforced concrete and hollow blocks and made an appeal to the association to help in securing standards of construction in these new fields which will insure safety, durability and permanence.

Mr. Richard L. Humphrey described the general program for the experiments now in progress in St. Louis, first as to reinforced concrete beams, second as to hollow concrete blocks, both as to strength and fire-resisting qualities.

In the afternoon the business session occupied attention. The President called attention to the limitations of the work during the year on account of lack of funds, the profits of the exhibit space at Indianapolis and the small sum received during the year from memberships being barely sufficient to pay the running expenses, although the members of the board of directors paid their own expenses to meetings. It was then decided to solicit advertisements to pay the cost of publishing the proceedings, and as these came in very slowly it was not possible to publish the proceedings until the close of the year. A contribution which was offered late in the year to help pay for the volume was returned at the end of the year, as the advertising finally obtained was sufficient to pay the expense of publication, when the proceedings were carefully reduced to their lowest terms.

The report of the board was then read by the secretary. It showed a membership prior to the convention of 174, receipts of $1,839.25, and expenditures of $1,678.32, leaving a balance of $160.93 on hand. No salaries were paid officials. The board held three meetings during the year, at Norfolk, Va., in April, at Atlanta City, N. J., in September, and at New York City in December.

The board offered for adoption by the association a form of charter for incorporating the association and by-laws for its government thereunder, embodying the provisions of the present constitution

with some slight modifications to suit the new forms of business.

The board's report was adopted and it was instructed to proceed with the incorporation.

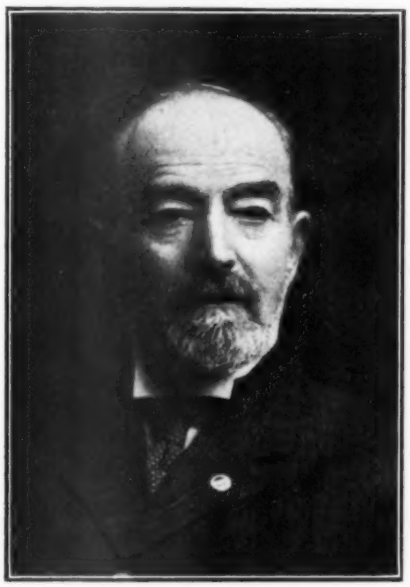
A general discussion of the subject of concrete block manufacture ensued under the leadership of A. N. Pierson, which brought out many details of practice, most of which demonstrated the fact that block makers generally are operating with but little knkowledge of the principles of connearly all of them accepted the situation crete manufacture, and if making good blocks have either stumbled upon a good method for their materials or have found one by tests which have consumed much time and given rise to many disappointments. The frequently expressed desire for advice from scientific experts showed that good results would in most cases have been obtained with much less expenditure of time and money if the scientific examination of materials and determination of methods had been made when the business was begun. This method of procedure seems therefore to be the one best for those just beginning block manufacture. The necessity of careful and thorough curing with the use of sufficient water, the quantity to depend upon the season and the weather was fully brought out.

Mr. J. P. Sherer reported success in hardening blocks in steam. He finds that the more porous blocks can be hardened with exhaust steam in a few hours, but that with dense blocks a higher pressure produces a better result. He also reported making good sewer pipe with natural hydraulic cement, the green pipes being subjected to a carbonizing process, using coke and steam. Portland cement does not take kindly to this process.

The subject of mixing was also thoroughly discussed and almost as many methods were reported as there were speakers. The object of all is to get as thorough a mixture of the dry materials as possible and to prevent separation during the wet mixing.

The convention passed a resolution asking Congress to make a larger appropriation for the testing of building materials, and asked each member to interview or write to his Congressman, urging the importance of the work.

The nominating committee presented as candidates for the offices elected by the association, Richard L. Humphrey, of Philadelphia, as president; Merrill Watson, of New York, as first vice-president; J. H. Fellows, of Scranton, Pa., as second vice-president; O. U. Miracle, of Minneapolis, as third vice-president; and A. Moensted, of Milwaukee, as fourth vice-president; and they were unanimously elected. The section on testing cement and cement products presented E. S. Larned, of Boston, as its chairman; that on concrete blocks and cement products presented M. S. Daniels, of Suffern, N. Y.; and later in the week the section on reinforced concrete selected T. L. Condron, of Chicago, the section on pavements and sidewalks selected George L. Stanley, Ashtabula, O., the section on art and architecture selected Charles D. Watson, of Toronto, as their chairmen, and they were duly elected vice-presidents of the association. The president was authorized to appoint chairmen for the sections of machinery for cement users, laws and ordinances and fireproofing and insurance, as



GEO. W. STANLEY,
Ashtabula, O.

they were not selected by the sections themselves.

There was some objection to the payment of the $2 fee required by the board of those who were not full members or delegates of members, and the president expressed the position of the board in fixing the charge, saying that the association is to much expense in regard to the convention and carrying on its business and that it seemed only fair that those who secured the benefits should aid in paying these expenses. The amount of the fee was fixed as reasonable for those not having the benefits of full membership and paying five dollars therefor, as there is no place where an equal amount of information can be obtained at any reasonable price.

PRES. RICHARD L. HUMPHREY,
Philadelphia, Pa.

1st VICE-PRES. MERRILL WATSON,
New York, N. Y.

2nd VICE-PRES. J. H. FELLOWS,
Scranton, Pa.

3rd VICE-PRES. O. U. MIRACLE,
Minneapolis, Minn.

At the evening session papers were presented by Louis H. Gibson, of Indianapolis, on "Cement Block Architecture"; by Charles D. Watson, of the Committee on Art and Architecture; by S. M. Woodward on "The Use of Cement and Concrete for Farm Purposes," and by Albert Moyer on "Hair Cracks, Crazing or Map Cracks on Concrete Surfaces." The substance of the last paper was printed in the January number of MUNICIPAL ENGINEERING. The other papers will be found elsewhere in this number. Mr. Watson's report was upon the use of cast stone in architecture and was illustrated with many views of handsome architectural structures erected by Mr. Watson's company. The treatment of the surfaces of concrete buildings was given prominence. Plastering was discouraged, and good results were reported from bush hammering or chiseling, where the finished surface does not come too close to the eye. Another good method is washing out the cement from the surface while the stone is still green. The speaker showed the necessity of co-operation of the architect and stone maker in selecting designs for ornamental blocks, and the superiority from an artistic standpoint of ornament designed expressly for construction in cement. Difficulties in securing proper labor to set stone and in shipping were brought out in the discussion.

A special session for the block makers was held at 9 o'clock on Thursday morning, at which there was full discussion of methods of mixing, coloring and waterproofing blocks, with reports of practice. Iron oxides were reported as safe coloring matter. Hydrated lime dissolved in water was recommended for wetting facing material of blocks to make them water tight. The method recommended as best is to grade the sand and aggregates so as to reduce the voids to a minimum and to mix the concrete with plenty of water.

The papers read at the morning session were by Henry Longcope on "Concrete Piles"; by W. W. Benson on "Machinery for Cement Users"; by J. L. Mothershead on "Waterproofing," and by Will J. Scoutt on "Legislation on Concrete Building Blocks." Some of these papers are printed in this number of MUNICIPAL ENGINEERING and others will appear later.

In the discussion J. P. Sherer gave some information to the effect that the best style of conveying blocks is on decked cars with transfer track and portable tracks in the yard. He also described his outfit of pneumatic tampers for compacting blocks, which cost about $700 and which he considers his best investment as a time and labor saver and in producing a dense block. He adds some five pounds per cubic foot to the weight of a block as compared with hand tamping.

At the afternoon session S. B. Newberry discussed his paper on "The Manufacture of Hollow Concrete Block," printed copies of which were distributed in the audience. O. U. Miracle read a paper on "Causes of Failure in the Concrete Block Business," R. K. Meade one on "The Selection of Portland Cement to be Used in the Manufacture of Concrete Blocks," and E. S. Larned one on "The Testing and Use of Portland and Natural Cements."

The special session beginning at 9 o'clock Friday morning, was devoted to sidewalks, under the leadership of George W. Stanley, Ashtabula, O. Much of this discussion was upon the manner of jointing walks, and it was shown that where frost goes deep the jointing must be more thorough and the possibility of moving stones independently must be greater than where there is but little frost and there is little or no danger of heaving the walk.

The section on art and architecture reported an organization for securing and distributing information in its field, Chas. D. Watson, Toronto, Canada, being chairman, and H. J. Jaxon, 681 Lake street, Chicago, secretary, in charge of the correspondence. Correspondents have been secured for the section as follows: A. C. Birnie, Ludlow, Mass.; Ed R. Diggs, 1 Madison avenue, New York; G. F. Fisher, North Tonawanda; D. B. Leslie, Saratoga Springs; W. J. Genther, Dispatch, N. Y.; A. S. J. Gammon, Norfolk, Va.; C. J. Farrar, Crafton, Pa.; Wm. Seafert, 226 LaSalle street, Chicago; B. H. Tillson, Osgood building, Racine, Wis.; W. P. D. Moross, Chattanooga, Tenn.; F. K. Mayne, Blue Springs, Neb.; J. E. Wilson, Jr., 128 S. First East street, Salt Lake City, Utah; H. N. Jones, Houston, Tex.; George B. Moogk, Waterloo, Ont., and others are desired.

Some time was spent in receiving invitations from various cities for the next convention, and the convention voted Chicago as its first choice, Columbus and Jackson equal as second choice and Columbus as third choice.

At the afternoon session R. P. Miller spoke on "Legislation Concerning the Use of Cement in New York City," J. C. McClenahan on "Manufactured Stone," and E. T. Cairns presented the report of the committee on "Fire Proofing and Insurance." Such of the papers and discussions as are not given in this number will find room later.

4th VICE-PRES. A. MOENSTED,
Milwaukee, Wis.

SEC'Y. CHARLES CARROLL BROWN,
Indianapolis, Ind.

TREAS. A. S. J. GAMMON,
Norfolk, Va.

J. P. SHERER, MILWAUKEE, WIS.
Chairman of Local Committee.

EDITORIAL COMMENT

The N. A. C. U. Convention.
The Value of Organization.

THE CONVENTION OF THE NATIONAL ASSOCIATION OF CEMENT USERS.

The second convention of the National Association of Cement Users held at Milwaukee, Jan. 9 to 12, was a greater success from every point of view than the first and most remarkable convention held the previous year. The actual enrollment was 10 per cent. greater and the actual attendance, including those who did not see fit to contribute to the support of the institution, was nearly 50 per cent. greater. The membership of the association was more than doubled, and the number of exhibitors and area covered were increased in the same ratio as the attendance.

The convention hall was all that could be desired for convention purposes, the only drawback being the necessity, on account of lack of room for exhibits, of putting some of the exhibitors close to and even in the convention hall. This gave rise to some complaint, since the convention would permit no interruption of its proceedings and enforced its ruling strictly. The exhibitors generally recognized the difficulties under which the local committee labored on account of the burning of the Exposition building, and gracefully. Much business was done by them, many machines and much material were sold, and this doubtless aided in making them satisfied with their accommodations, though the necessity of dividing the convention and of overflowing into adjacent storerooms gave rise to conditions which were far from ideal.

The association approved the recommendation of the board of directors that the society be incorporated, and approved the articles of incorporation and by-laws presented. Under their provisions the board of directors will hereafter determine the location of the convention and can prevent any difficulties which might arise from lack of space or change in conditions in the proposed convention city during the year.

The convention programme was evidently one of absorbing interest, the attendance being constantly large even to the last moment of the last session, which did not adjourn until after 6 o'clock on Friday afternoon. Those interested in block manufacture feared during the first day that their interests did not have their full recognition, and an experience meeting was set for the hour before the regular convention session on the second day. This was so successful, under the leadership of Mr. A. N. Pierson, that a second meeting was held at 9 o'clock on Thursday, and a similar meeting for those engaged in concrete paving was held on Friday morning, under the leadership of Mr. George W. Stanley. When the part of the regular programme concerning block making and use was reached the block makers found plenty of material for study, and that, with the extra attention given them in the extemporaneous discussions interpolated in the programme, they were the center of attraction and had their full share of the time, notwithstanding the great show of force made when a call was made for a count of those making blocks and of those interested in them as building material.

Almost the entire board of directors was re-elected and Chicago was indicated as first choice for the next place of meeting.

The association evidently meets a need of the day, and under its present management will doubtless duplicate its past successes and, with funds somewhat increased, will be able to do some things which it could not compass last year on account of the slow responses to calls for new members and for other assistance in its work. Convention enthusiasm dies soon and memberships not taken out at the convention are likely to remain vacant until the next year. This difficulty will be less for the second year, and the two good volumes of proceedings will be additional attractions to new members and to old ones for renewing.

This association is one of the few which combines with its technical features the business feature of exhibits of materials and machinery in which its members are interested, and while this dual field gives rise to some friction and some difficulties, it has thus far been successfully covered and there is little disposition to make a separation.

Another successful year is predicted for the association.

THE VALUE OF ORGANIZATION.

Mr. I. S. MacDonald prepared a paper with the above title for the meeting of the National Association of Cement Users in Milwaukee which was crowded out by the pressure of the discussions on the last days of the convention, which shows some of the benefits of organization of local concrete men in securing proper recognition of their product by the building inspection department. The need of educational work in this department in the various cities was well brought out in the papers presented, but Mr. MacDonald's paper shows a means of applying the necessary effort at the right point and with sufficient force to insure its consideration. The difficulty seems to be that the concrete men themselves need education and that they are so careful of their own individualities that it is difficult to collect them into an organization. It is only when some one or more not directly engaged in the use of cement, like Mr. MacDonald in his case and like a number of the officers in the N. A. C. U., take up the matter and form the nucleus of organization that one can be made possible and that is value can be demonstrated.

The value of an organization was recently shown in the development of a building ordinance in another city. Here the building code was under revision by a committee of the department, with the aid of the architects, and when the question of smoke prevention was reached the architects remembered the discussion of this subject by the local technical club and called on it for assistance. The club formed a committee, which, acting with the approval of the club, drafted the needed sections of the ordinance, and it is now in operation. A similar good effect upon the provisions regarding concrete construction might have been secured if there had been an organization interested in presenting the merits of the new building material.

In the same city some new bridges had their general style and method of construction largely defined by a commission which was appointed as the result of a movement which secured the co-operation of various organizations having weight in the community, and the money for the bridges was readily secured and their quality was probably improved greatly through the influence of this organization. It may be of interest to know that nearly all the bridges were designed as reinforced concrete structures.

While Mr. MacDonald's text is directly connected with the improvement of conditions in the concrete building field, the application of his sermon may be made to any line of civic improvement and is well worth careful consideration.

The American mind seems to be influenced greatly by the idea of an association, and a very few persons can secure results which would be entirely out of reach of their individual efforts if they will form an organization which contains some well-known persons in whom the public has confidence, and especially if they can get the indorsement of a number of such organizations. The idea must have merit or it could not pass the inspection of these organizations, and it must be free from private benefit, but the fact remains that the organizations can secure the recognition which no number of individual members could secure with many times the labor.

THE QUESTION DEPARTMENT

WHO IS LIABLE FOR DELINQUENT WATER RENTALS.

Can delinquent water or light rentals become a lien on the realty on which it was consumed?

Can a property owner be made liable for rentals left unpaid by his tenants?

If rentals are unpaid by a tenant and water is turned off, can the owner compel city to furnish water to new tenants?

Can a city legally collect water on flat rate basis in advance?

There seems to be a diversity of opinions among the legal fraternity on this subject.

W. E. FULK,
Supt. Waterworks, Decatur, Ind.

The diversity of opinion seems to be justified by the lack of uniformity in conditions and consequent lack of uniformity in practice. The questions must be answered after full investigation of local conditions and customs. Some cities proceed on the principle that the contract for water is made for or is guaranteed

by the property served, while others make contract with the person served, whether owner or tenant. The answers to the first three questions depend on which of these practices is followed. There seems to be no doubt as to the legality of collection of water rates in advance if flat rates, or of requirement of a deposit if meter rates are collected.

REPAIRS TO CEMENT-LINED WATER MAINS.

Can you inform me of any method of repairing leaks in water mains constructed of cast-iron pipe lined with cement? It has been the custom of the Water Department of this town, when such a leak occurred, to take out the damaged section and replace it with a whole new pipe.

It occurred to me that there might be some cheaper way of repairing these pipes, and if you or any of your readers can enlighten me on this subject I will be much obliged. SUBSCRIBER, Spencer, Mass.

The writer knows of no way of repairing cement-lined water mains equal in economy and certainty to replacing the leaky section with a new one. Can our readers give any light on the subject?

BOOKS ON CEMENT PIPE.

Please refer to the best published work on the subject of cement pipe—that is, pipe made of cement, sand, broken stone, etc.—or to those who may have patents on same and desire to farm out certain territory. H. M., Omaha, Neb.

The only books referring to the manufacture of cement sewer pipe are Buel & Hill's "Reinforced Concrete" ($5) and Marsh's "Reinforced Concrete" ($7). Reference should be made to the "Business Directory" printed in each number of MUNICIPAL ENGINEERING, under the headings "Cement- Pipe Molding Press" and "Cement Sewer-Pipe Machinery," for names of those selling machinery and processes for making cement sewer pipe.

BRICKS IN A CISTERN.

Is there a book that gives the measurements of cisterns or the number of bricks it takes for a wall?
G. B. W., Geneva, O.

Kider's "Architect's Pocket Book" ($5) gives all the tables on this subject that can be desired. Maginnis's "Brick-Laying" ($1.50) is also a good book.

WATERPROOFING OF ARTIFICIAL STONE.

Can you cite me to any article or monograph on the use of water-glass for the waterproofing of artificial stone, or any article on the subject in general.
W. H. C., Portland, Ind.

The "Handbook for Cement Users" has some information on the subject, which was taken from back numbers of MUNICIPAL ENGINEERING. There is no extended article on the subject known to the writer.

BUILDING ORDINANCES AFFECTING CONCRETE BLOCKS.

Will you kindly let me know what cities have passed ordinances on hollow concrete building blocks and what they consist of? Or, where could I obtain the same? FRANK MARTIN, Beloit, Wis.

The ordinances in Minneapolis will be found in MUNICIPAL ENGINEERING, vol. xxix, p. 441; those of Philadelphia on p. 356, those in Newark, N. J., on p. 358, of the same volume. Some provisions proposed for Milwaukee will be found elsewhere in this number in the article on "The Value of Organization."

BOOK ON ANALYSIS OF CEMENTS.

I am interested in cements and desire to have a book on chemical analysis of Portland cement or cements, giving the methods of analysis.

The "Handbook for Cement Users" ($3) gives the methods of chemical analysis of cement and cement materials proposed by the Society for Chemical Industry. R. K. Meade has a small book on the "Chemical and Physical Examination of Portland Cement" ($1).

A CONCRETE SILO.

Kindly give me some instructions how to build a silo of cement and proper proportions of sand to cement as mixture. We have a good sharp sand, but no gravel or crushed stone.
A. EVERETT, Brainerd, Minn.

A silo can be built in the same way as a cistern, using wooden forms or some of the various patented forms offered in advertisements in this magazine. If of considerable height, some steel reinforcement should be used. The description of the construction of the water tower in MUNICIPAL ENGINEERING, vol. xxvi, p. 162, will give some idea of methods of procedure, though a silo would not require as heavy construction, that of the upper section of the standpipe being fully strong enough for a silo of any ordinary height. It will be noted that the proportions of materials used in this case were 1 of cement to 3 of clean sand in the wall. The exact proportion must be determined for the sand actually used.

STICKING OF CONCRETE TO MOLDS.

Can you refer me to any one who makes brass or brass-lined faces for machines for hollow blocks? I can make a good-enough machine if I could get a face that would not stick. Can you tell me of any material that will prevent this sticking of cement to cast-iron faces?
H. W. B., ———, S. C.

One or two machines use brass or brass-

lined faces for block molds, but there does not seem to be any particular advantage in using this material, as corrosion in a face of any material roughens it enough to make wet concrete stick to it.

The methods of preventing sticking of concrete to mold faces are to make the concrete dry enough so that it will not stick, or if this is too dry for the desired quality of block, to coat the face of the mold with paraffine or with some of the preparations advertised elsewhere in this magazine. The paraffine can be dissolved in gasoline, or even petroleum, and applied with a brush as often as it wears off.

CONCRETE-BLOCK ARCHITECTURE.

I notice an article in your last number by Mr. Gibson regarding concrete-block manufacture, which I think very much to the point; so much so, in fact, that I have shown same to a capitalist who has stock in a block factory which is run by a retired farmer, who turns out some of the most horrible examples imaginable. This man says he "don't want to figger on no plans made by any *arch*-itek," and some of the prospective builders here are wondering why the architects do not take more interest in the cement business.

Last season I made plans for an eight-room brick school building, to be built in the northern part of this State. On account of cost of brick it was decided to use cement blocks, the party to whom was awarded the contract saying he could carry out the design and measurements of original building. Some little time after contract was awarded I was called to meet with the School Board in regard to some proposed changes. Upon my arrived I was informed that the plans didn't work out with the blocks, and that it would be necessary to make all of the windows six inches narrower and four inches lower and also change the size of vestibule and make stairway one foot narrower, etc., etc. After the smoke had cleared away I mildly suggested that it was possible that the blocks did not work out with the plans, and wanted to know what would be done to compensate for the 20 per cent. or more of glass space that had been removed, provided we should decide that it was advisable to destroy the proportions and appearance of the building. The contractor was positive that "there'd be lots of light left, and ...e windows wouldn't be so bunglesome." No changes were made in the size of windows, however, but it required heroic treatment from the start to prevent the block man from destroying a $20,000 building.

I am a firm believer in cement work, but I also believe that more brains and less sand should be used if success can be reasonably expected.

As now used in this locality the cement blocks are but a cheap substitute for brick, and so far as artistic appearance is concerned no apology is needed for the old sod house plastered inside and out with "native lime."

I believe the time will soon come when buildings will be built of cement on account of durability, instead of cheapness, and the blocks will be made to fit the plans and not the plans to fit the blocks, as is too frequently the case now.

In the same number I also notice an inquiry regarding the cause of cracks below and around openings. I enclose one of my circulars, which will give an idea as to the method in foundations for all kinds of brick and stone buildings, and when properly carried out it is a perfect success. A hole ten feet square in a brick wall one foot thick will not weight as much as one hundred cubic feet of brickwork; consequently it does not require as much foundation to support the "hole" as it would to support the one hundred cubic feet of brickwork which would be required to fill a hole ten feet square in a wall one foot thick.

A. H. DYER, Architect,
Fremont, Neb.

Mr. Dyer's circular gives a number of drawings showing his method of transfering the weight under openings to the foundations under the pilasters or solid parts of the wall so as to make the weight per square foot of foundation as uniform as possible, and thus reduce the danger of cracks in walls. He will doubtless send copies of the circular on request.

WANTS TO BUY INDEPENDENT CEMENT.

In this territory the lumber trust is attempting to control the cement and building block business. I want the names of those who can and will furnish the block cement direct, when ordered in car lots. There are supposed to be some ten independent lumber yards in this territory, but they are linked together and while the yards here represent to the the trade that they buy cement to sell to us, the fact is every car of cement is divided among these different yards and then the price is so raised that we cannot compete with their product, as they furnish lumber, carpenter, building blocks and all at the same price to the man who wants the building as to the independent block maker. They have run the price of standard brands of cement to $6.00 per barrel. This is why we want the names of those who will sell cement direct to the builder. H. A. M., Reinforced Concrete and Cement Products, ——, Neb.

BOOKS ON BUILDING CONSTRUCTION.

Modern farm buildings away from centers, consisting of house, stable, barn and cow barn are contemplated. Practical knowledge is desired regarding foundations, water supply, sewage disposal, lighting and heating. Of course, I shall employ an architect, contractors and builders, but I wish to get reasonably well posted and know what I may expect before starting. Will you help me get this information? J. F. S., Bath, Me.

Coleman's "Sanitary House Drainage" ($2); Colyer's "Treatise on Water Supply, Drainage and Sanitary Appliances of Residences" ($1.50); Denton's "Water Supply and Sewerage of Country Mansions

and Estates" ($1.25); Kiersted's "Sewage Disposal" ($1.25); "Stables, Outbuildings, Fences and Miscellaneous Details" ($2.50); "Barn Plans and Outbuildings" ($1.50), are some of the books that will be found useful.

HOW TO WATERPROOF BASEMENT UNDER OUTSIDE WATER PRESSURE.

In response to the question in MUNICIPAL ENGINEERING, vol. xxx, p. 18, Charles Becker, Milwaukee, Wis., sends the following formula for a plaster to use on the wall of a basement under water pressure to make it watertight:

Use the following mixture for a plaster:
1 lb. Caustic Potash.
2½ lbs. Powdered Alum.
Dissolve in 5 quarts of water and use with 3 sacks of Portland cement.

BOOKS ON CARPENTRY INSPECTION.

I am in search of a good, practical book for a carpenter superintendent—a book that contains good information on construction work in general, as well as tables, etc. C. E. R., Pittsburg, Pa.

Byrne's "Inspection of Materials" ($3) may be the book which will fill these needs. Part II of Kidder's "Building Construction and Superintendence" ($4) is devoted to carpenter's work.

HANDBOOKS OF STEEL SHAPES.

Can you give me the addresses of those who issue books giving shapes of steel?
E. E. P., Montgomery, Ala.

The Carnegie Steel Co., the Jones-Laughlin Co., the Cambria Steel Works have offices in the principal cities, and all of them have offices in Pittsburg. The Osborn Engineering Co., Cleveland, O., issues a book having some original features.

MAKERS OF BEST RAIL FOR USE IN STREET PAVEMENTS.

Will you please give me the names and addresses of several companies that manufacture both "Tee" and "girder" rails for street railway purposes? We are contemplating a change in the style of rail to be used on our paved streets, and I want catalogues from some of the manufacturers in order to select the section best suited for pavements. I would be glad to receive any suggestions you could offer. I have read quite a number of articles on the subject of track construction on paved streets, which you have published in your magazine from time to time. The one in vol. xv, p. 348, is especially valuable. W. C. CAMPBELL,
Supt. Public Works, Columbus, Ga.

The following are makers of rails who have special forms from which selections can be made for special purposes:

Cambria Steel Co., Johnstown, Pa.
Lorain Steel Co., Johnstown, Pa.
Pennsylvania Steel Co., Steelton, Pa.
Carnegie Steel Co., Pittsburg, Pa.
Illinois Steel Co., Chicago, Ill.

METHODS OF MAINTENANCE AND CLEANING OF STREETS.

This place has a population of from 12,000 to 15,000. No paved street; most streets graded. No street commissioner. A street contractor furnishes the city with mules, carts, wagons, road machines, other implements and necessary labor. Contractor is required to give his personal attention to all work and perform same under the direction of the street committee of the City Council. The city furnishes all material and reserves the right to terminate the contract after ten days' notice for any cause. Contract includes the removal by contractor of all garbage. Kitchen and liquid slops are removed under another contract, by which a contractor furnishes necessary number of tank carts for work, under the supervision of the Police Department.

Will you give me the result of fifteen or twenty of the most progressive cities with populations of from 15,000 to 20,000 whose street commissioners might furnish me with copies or a summary of the ordinances governing the maintenance of their streets. Is there any publication on this subject? D. S., Natchez, Miss.

The following cities would probably have something of value to report in this matter: Ft. Smith, Ark.; Hannibal, Mo.; Jackson, Tenn.; Alton, Cairo, Freeport, Jacksonville, LaSalle, Streator, Ill.; Elkhart, Elwood, Hammond, Ind.; Ashtabula, Chillicothe, Marietta, Piqua, Steubenville, O.; Hagerstown, Md.; Alexandria, Va.; Meridian and Vicksburg, Miss.; Asheville and Raleigh, N. C.

MUNICIPAL ENGINEERING will publish anything of value which our correspondents may send in on these subjects, whether from cities of the size named or those larger or smaller.

BOOKS ON CIVIL ENGINEERING.

Being desirous of purchasing a set of text-books from which I may be able to obtain a practical knowledge of civil engineering in all its details, and thinking possibly you would have a list you could recommend or that you could inform me where I could get them, I have decided to write to you in quest of same.
W. C. R., Cicero, Ind.

It will be difficult to get a knowledge of civil engineering in all its branches without personal instruction in school, office or field. The following may be named as excellent books in their fields, but there are many more equally as good in their lines.

Johnson's "Surveying" ($4).
Baker's "Roads and Pavements" ($5).
Turneaure's "Water Supply Engineering" ($5).
Folwell's "Sewerage" ($3).
Johnson's "Engineering Contracts and Specifications" ($5).
Trautwine's "Civil Engineers' Pocket Book" ($5).

BEST POWER FOR CENTRAL ELECTRIC STATION.

The writer is one of a committee to investigate the feasibility of constructing a central power station to supply electricity for operating a large number of pumping plants raising water for irrigating and domestic use in this valley. We believe we will have sufficient demand for current for pumping and lighting use, to warrant installing a plant of 3,000 kw. proportioned in three units of, respectively, 500, 1,000 and 1,500 kw., when plant is fully equipped, first installation probably to be 1,000 kw.

Can you give us information direct or refer us to authoritative sources for information as to best., i. e., greatest economy and efficiency of means of operating the dynamos, whether by some form of steam engine, by steam turbine or by gasoline engines?

Can you give relative efficiency of h. p. developed, expressed in heat units, of fuel consumed of the three methods above mentioned? Information concerning steam turbines and Diesel engines is especially desired, and will be greatly appreciated.

G. P. R., ——, Cal.

It is not possible to discuss this subject intelligently, so far as a particular case is concerned, without a full knowledge of the particular circumstances. In some cases economy in first cost is the essential, less attention being paid to economy of operation. In other cases the first cost is not an important factor, everything requiring low cost of operation. The cost of fuel is a very important item in the determination of the kind of power to be used. The possibility of using by-products of heat, water, gas, or other nature may often be the ruling factor. The best procedure would be to maek a full study of all the methods of power production likely to be applicable, under the direction of an expert in power production, who can readily cut out the methods not available and can save time and effort by using the results of his experience.

Books upon power production and the publications of manufacturers of apparatus will be of much assistance, but the guidance of the expert recommended should be of the most value. Reference may be made to the lists of engineers in the "Business Directory" given elsewhere in this magazine.

EFFECT OF SEWAGE ON CONCRETE.

I am anxious to obtain some information relative to the effect of either sewer gas or sewage upon joints of brick sewers.

C. H. P., San Jose, Cal.

Ordinary sewage has no effect upon Portland cement concrete. Natural cement mortar is sometimes washed out of the joints of sewer brick work, but good Portland cement concrete is not affected. There have been a few instances of serious effect of acid discharges from factories upon Portland cement concrete, but these are few and very special in character.

ROADS AND PAVEMENTS

Cement Sidewalks in Springfield—U. S. Public Road Office—Street Assessment Case—Rockford Street Repairs—Cleveland Pavements—Chicago Street Improvements—Mankato Paving Case.

Cement Sidewalks in Springfield, Ohio.

The annual report of W. H. Sieverling, city engineer of Springfield, O., shows that much work was done during 1905 under the direction of the engineering department, although the construction of sewers and street paving has been entirely held up pending the outcome of the plans for the proposed sanitary sewer system. He states, however, that a greater amount of cement sidewalks has been constructed than in Cincinnati, and adds that, had it not been for the wet weather at the end of the close of the season, the amount would have been double that of Cincinnati. He recommends the construction of cement cross-walks instead of limestone in the future. A laboratory for making physical tests of sand and cements to be used by contractors for all kinds of cement construction has been installed. Its free use for the contractors and citizens has already demonstrated that a better quality of cement is now being shipped to Springfield than heretofore.

The Work of the United States Office of Public Roads.

The report of the office of public roads of the Department of Agriculture for the last fiscal year indicates that the scope of that office has broadened considerably. The name has been changed from "office of public-road inquiries" to "office of public roads," on the theory that the work has now reached such a stage that the seeking for information should be supplemented to a greater extent than ever before by the giving of information. Part of the work now connected with the office of public roads has heretofore been done in the bureau of chemistry, the division of tests of that bureau having in charge the testing of all road materials and materials of construction relating to agriculture. Under the reorganization the tests and investigations comprise one division of the work of the office, under the immediate supervision of the assistant director. All the field construction work in the building of object-lesson and experimental roads comprises another division, and is placed under the immediate charge of a highway engineer. The collection and compilation of information on all phases of roads and road improvement is concentrated under the chief of records, and the routine, clerical and administrative work is provided for by the appointment of a chief clerk. The report says:

The object-lesson method, which has been found so effectual in many lines of educational work, has been found to be peculiarly appropriate for the purpose of the office in giving instruction in road building. A larger number of object-lesson roads were built by the office during the past fiscal year than in any year since its establishment. The plan, briefly stated, is as follows: Upon request of a local community an engineer is detailed to make a preliminary examination for the purpose of determining what character of road is best suited to the locality, what materials are available and what the probable cost will be. In many cases he makes the necessary surveys and prepares plans and estimates. Later a road expert and road machinery expert are sent, and in many cases a full complement of modern road-building machinery. The men and machinery are allowed to remain at one place a sufficient length of time to demonstrate practically how an improved road should be constructed, and to so instruct the local officials that they may continue the work of their own accord thereafter. During the year twenty-one roads were built in nine different States, in the construction of which stone, shale, burnt clay, sand clay, shell, gravel and marl were used. The individual reports on these roads show a maximum cost of 98 cents and an average cost of 55 cents per square yard for macadam roads, and an average cost of 9½ cents for sand-clay roads. The cost of the one burnt-clay road is shown to be 20 cents per square yard, and of the one shell road 34 cents per square yard. Three of the object-lesson roads were built in Ohio, one in Illinois, three in Missouri, one in Kansas, two in Washington, one in Texas, one in Louisiana and seven in Florida.

Burnt-Clay Road Building. — It is a well-known fact that in many sections of the country natural hard road materials are not available. In some cases this difficulty has been overcome by cheap transportation, but there are vast sections of the country where the problem cannot be solved in this way. It has therefore been one of the chief aims of the office to devise means of adapting and uitilizing the local materials for road building. In the great Mississippi delta experiments have been conducted in the burning of the clay or "gumbo" in order to obtain suitable road material, and the successful results realized from an experimental burnt-clay road at Clarksdale, Miss., would seem to point to at least a partial solution of the problem. In the preparation of the road for burning it was first plowed up as deep as four mules and a steel plow could break it, from ditch to ditch, a width of twenty feet, after which it was crowned with a road machine. Trenches were then cut across the road four feet apart and about twelve inches deep, earth being thrown up so as form ridges between the trenches. Next a layer of cordwood was placed over each trench, the ends of the sticks resting on the tops of the ridges, the intervening trenches forming flues across the road. Upon this floor of wood was thrown gumbo, or clay, in lumps and clods, so as to form an open layer only partially covering the wood. On this was placed a second floor of wood, the sticks being laid at right angles with the road and as close together as possible, being supplemented with sticks, chips, bark and brush. On this floor was thrown a layer, about ten inches thick, of gumbo, partly clods and partly pulverized. Firing was then begun and continued much the same as with a brick kiln. After the road was burned it was smoothed down so as to form a proper crown and was opened to travel. A report received from the chief engineer of the Yazoo Mississippi delta district indicates that the burnt-clay cost only one-fourth as much as a gravel road adjoining it, and that after being used all winter the gravel showed signs of deterioration, but the burnt clay was in good condition. Later on he states that the burnt-clay idea has taken wonderfully, and that the county board has appropriated $25,000, most of which is to be expended in burnt-clay roads.

In a great many instances it has been found sufficient to send an engineer to examine into the local conditions and give advice as to what course should be pursued. Much of the work that was done during the past year was of this character. Participation in conventions of road organizations has been somewhat curtailed, but there have been a number of cases where country road officials have met in conventions to discuss ways and means for improving the country roads, and engineers have been detailed to give them practical information and to answer such inquiries as were pertinent to the subject.

Schools and colleges throughout the country are now directing considerable attention to highway engineering, and the office has undertaken to co-operate in this work to the fullest extent. A plan has been adopted of employing each year several graduates of reputable engineering schools throughout the country as civil engineer students. These students are given instruction and practical training

in all branches of highway engineering, including laboratory and field work. They receive a salary of $50 per month and field expenses for a period of one year, after which they may be promoted, at the option of the Secretary of Agriculture, without further examination, on account of the fact that preliminary to their appointment they are required to pass a rigid civil-service exxamination. If any general improvement in the roads in this country is to be made it is of vital importance that there be a sufficient number of highway engineers to properly direct the work. By promoting highway engineering in colleges and by carrying on the post-graduate work above outlined the office will be aiding, in a measure at least, in this work.

There are practically no data available from which it can be ascertained how much money is being expended in the United States on roads, how it is being spent and what are the results of such expenditures. Such data, compiled for the entire United States, would not only be of great interest, but would be valuable, as they would show in a measure at least to each county whether it was obtaining a due return for its outlay. Such a work of collection and compilation is now being carried on and reports will be available within the present year for every county in the United States.

The laboratory work of the office has been mainly directed toward making routine tests of rocks for macadam road building; clay for burnt-clay roads, for drains and for paving bricks; sands, mortars, cements and concretes; materials for municipal street paving in brick, wood blocks, asphalt, etc.; and in a few instances materials for building and other structural purposes. Special tests and investigations have also been carried on in the laboratory in connection with reinforced concrete and cement concrete for rural construction, and a bulletin has just been issued on the subject.

An investigation of special importance is that on the corrosion of iron and steel wire fences. A bulletin has just been completed on this subject, and will shortly be available to the public.

Special investigations and experiments have been carried on from time to time in connection with the decomposition of rock dust, with a view to the possible improvement of the binding quality of the road material.

Street Repairs In Rockford, Ill.

In his annual report, City Engineer Main, of Rockford, Ill., recommends that the city change the method of street construction by using cement or concrete curbing instead of plank curbing. He calls attention to the need of asphalt repairs, and says:

Approximately 2,100 square yards of tar macadam were used in repairing the asphalt pavements at an average cost of 82 cents per square yard, making a saving of $1,800, and I believe these repairs are the best part of the pavement today.

Our repair work could be done more satisfactorily if we had a small steam roller, and I would recommend to the city council that a six-ton steam asphalt roller be purchased for use in our tar macadam work, as the guarantee of the Barber Asphalt Paving Company on East State St. and South Main St. has expired, which will necessitate nearly twice the amount of repairs next year.

We now have 47 miles of macadam streets, and the small roller would also be of great assistance in repairing them, as it is almost impossible to repair service ditches without thoroughly wetting and rolling the same. I have been investigating the roller question and find that at a small additional expense a roller could be equipped with an extra water tank and sprinkler attachment, so that we could sprinkle the ditch repaired at the same time it is rolled. It is the intention of the department to charge the repairs to the party tearing up the street.

A Street Assessment Case In Tacoma.

The supreme court has affirmed the decision of the superior court of Pierce county, confirming the assessment on certain lots for the improvement of South C street, from Division avenue to South Seventh street, Tacoma, Wash. The principal question involved was whether or not the assessments for the improvement had been justly distributed. It was claimed that inasmuch as the lots assessed sloped to C street, and that the residences thereon fronted on another street, the assessments had been made excessive. The supreme court holds that the judgment and distribution was as fair as any that it could devise.

New Cleveland Pavements.

The completion of all paving work undertaken by the city of Cleveland O., during 1905 was announced by J. P. Bayne, city engineer in charge of paving, December 23, 1905. He says more paving was laid during the year than in any other year in the history of the city. A total of 27.6 miles of various kinds of pavement was constructed at a cost of $937,-136.29. The material used was divided as follows: Asphalt on four streets, 463.940 sq. ft., or 2.5 miles, $116,807.72; Medina stone on eleven streets, 457,918 sq. ft., or 2.5 miles, $193,879.54; tar macadam on one street, 63,200 sq. ft., or 0.4 mile, $19,-268.62; brick on ninety-eight streets, 3,-108,423 sq. ft., or 22.2 miles, $647,180.41.

Chicago Park and Street Improvements.

The report of the South Park Commissioners of Chicago shows that ten parks, which a year ago were little more than unimproved playgrounds, have been remodeled by landscape gardeners. The park board has expended $235,137 for improvements on old parks, $1,575,461 for improvements for new playgrounds, and $288,000 for new park sites. The total area of the South Park system is now

2,172 acres. The commissioners spent $1,082,939 for maintaining the parks.

In Davis Square, one of the new playgrounds at Forty-fifth street and Marshfield avenue, 100,000 children bathed in the swimming pool in one month.

The annual report of the Lincoln Park board shows that the extension of the new park in Lake View, the completion of the new beach for north shore protection, with the consequent filling in of a large strip of the lake and the building of a stone wall, the purchase and planting of many hundred trees, transformation of nearly all the walks and drives, and the completion of a new birdhouse are some of the most noteworthy improvements.

During 1905 93 miles of streets were paved at a cost of about $3,000,000, and 24.4 miles of new sewers built at a cost of $641,000. Of the 93 miles of paved streets, asphalt was used for 48 miles, macadam for 35 miles and the rest were of brick, granite, novaculite and creosoted block.

Final Decision In Mankato Asphalt Paving Case.

The opinion delivered recently by the United States court of appeals in the case of the Barber Asphalt Paving Company vs. the city of Mankato, Minn. upholds Judge Lochren on every point. It holds that the changes made in the contract were not beneficial to the Barber Asphalt Paving Company, and that the latter company was not bound by the decision of the State courts in the case of John Diamond vs. the city of Mankato, because the Barber company was not a party to the action. It recites that the city, during the trial of the Diamond case tried to have the Barber company made a party to the action, and says that the property owners were to blame for not making the company a party to the action. The court said:

We recognize to the fullest extxent the necessity for holding municipal corporations to all the limitations imposed upon them by law. We also recognize the necessity of rigidly subjecting them to the observance of all safeguards provided by law for the purpose of securing honest and fair administration of public affairs; and we fully agree with the reasons assigned by the supreme court of Minnesota for requiring a strict enforcement of the rule laid down by that court for the guidance of municipal authorities in making contracts for public improvements. But the rule itself, heretofore quoted in full, is not a fast and unyielding rule. It does not prohibit all variations from the specifications. The charter of the city requires the execution of a formal contract after the "lowest, reliable and responsible bidder" is ascertained, and it must be such as is approved by a two-thirds vote of the city council.

The phraseology of the contract is left to be determined by the council. The supreme court of Minnesota construing the charter provisions on this subject, has declared that the contract must not contain substantial provisions beneficial to the contractor which are not included in or fairly contemplated by the terms of the specifications. This rule manifestly and properly allows a reasonable degree of latitude in details involved in the execution of powers conferred by fundamental law, essential to an intelligent and practical administration of public affairs. It does not and should not avoid a contract for important public improvement after performance by the contractor to the full satisfaction of the city, merely because of the use of words in the contract not found in the specifications, or for any mere irregularity, not involving substantial rights.

The question, therefore, is whether the departures in question involve substantial changes to the contractor not fairly contemplated by the terms of the specifications. In answering this question we cannot shut our eyes to the conceded fact that the changes in question were not the result of any pre-arrangement or secret understanding between the city and the Barber company, or deny the effect of this concession upon our minds.

The addenda, to the effect that the city would not enforce the penalty of $20 a day for delay in the event such failure came about through "unavoidable causes," when considered in the light of the specifications which were in effect the obligation assumed by the contractor, we think is nothing more than a reasonable construction placed by the parties themselves upon the terms of the specifications as they originally stood, and may be said to have been fairly contemplated by them.

The same views might dispose of the addition of the word "preventable" in the guaranty clause, but there are additional reasons why the introduction of the word does not vitiate the contract. The original specifications after the clause providing that the contractor should keep the street in repair for ten years read as follows: "If during that period it is found that the pavement is defective from overburning or improper mixing of material, or any other cause, or that the work has been done in an unskillful manner," the contractor shall, etc.

This language clearly imports an obligation to do something, the necessity for which should arise from some act of commission or omission by the contractor, which in its nature is preventable by him. The general words, "or any other cause," by a familiar rule of construction expressed by the maxim *nosciture a sociis*, do not enlarge the scope of the particular words in the midst of which they appear. The addition of the word "preventable," therefore, has relation to causes of the same kind as those particularized, namely, to over-burning or improper mixing of material, and do not diminish or affect the scope of the contractor's obligation.

But if the words "or any other cause" are not limited by the context as just indicated, the language of the specifications in our opinion did not impose upon the contractor the obligation to repair damages occasioned by causes beyond its control and which could not, under any circumstances, have been prevented by it. The measure of its duty was "ordinary care"; that kind of care in the particulars specified, as other persons similarly situated exercise under like circumstances, and nothing more.

From this it is apparent that the addition of the word "preventable" did not

at all reduce the contractor's obligation. If the baneful results could not, under any circumstances, have been prevented by the contractor, in our opinion, no liability would have arisen either under the original or amended specifications.

We think Brown, J., who dissented from the opinion of the majority in the Diamond case, expressed the correct view when he said: "If the court is to be understood as holding that public authorities engaged in a lawful public improvement may not, as to such details as are here involved in the exercise of sound judgment, in good faith and without fraud or collusion, change and modify the terms and provisions of the contract under which the work is to be performed, from the specifications and conditions made part of the proposals and invitation to bidders, I dissent."

Accordingly we conclude that the case, on its merits, is with the plaintiff and we cannot give our sanction to the refusal by the city to make the necessary assessments—the only thing, which in law it could do—to provide means for paying for the improvement which it is now enjoying.

Is the contract in question void because it creates an indebtedness against the city in excess of a permissible limit fixed by statute?

An answer to this question necessarily involves a consideration of the nature and character of the relief sought in the present action, and, incidentally, a consideration of defendant's contention that no liability exists against the city for failure to make assessments in order to pay for plaintiff's work.

By the wrongful act of the city in failing to make assessments against property owners, the Barber company was deprived of any means of securing payment for its work. It had agreed by contract that its only resort should be to such assessments, and the city, by accepting the charter from the State, agreed with the State and with all parties interested, that it would perform its duty and make the assessments as required.

In our opinion, the contract did not create a debt against the city within the meaning of the statute. Nor is the cause of action in this case founded on a debt. The contract obligated the officers of the city to perform a duty which the law imposed upon them, and nothing more.

This suit against the city is for damages for failure to discharge this statutory duty. The elements creating liability and necessary to be stated in a declaration at common law would have been: (1) The circumstances creating the duty, (2) the duty, (3) and the breach of the duty, and nothing more. Such averments are all that the plaintiff in tihs case employs in its complaint and they are sufficient to constitute a meritorious cause of action.

After citing a number of opinions in previous cases, the court concludes as follows:

The conclusion reached on the questions last discussed is decisive of the next question urged by counsel for the city, namely, that because a contract between the Barber company and the city creates a debt against the city, it is void for the reason that there was no money on hand or appropriated, levied or in process of collection when it was incurred, applicable to its liquidation, as required by the city charter. This contention likewise misconceives the obligation imposed upon the city by the contract as well as the nature of the demand sued for in this action.

WATER AND LIGHT

St. Paul Water Works—Public Ownership Commission—Kansas City Natural Gas—New York City Improvements—Municipal Lighting Plant—Cincinnati Water Works—Peoria Gas Rate—Knoxville Water Suit—Water Waste in Washington.

St. Paul Water Works.

The annual report of the water board of St. Paul, Minn., shows that during 1905 3,614,488,478 gallons of water were consumed. This is an average of 9,902,708 gallons daily, an increase of 283,601 gallons over the average of 1904, and an increase of 1,836,213 gallons over the average three years ago. The consumption of water was about equally divided between the high service and the low service. The report shows that the net cost of the water works to date is $4,395,347.35, of which $91,683.97 was put into improvements in 1905. The works have been paid for by bonds amounting to $2,400,000 and expenditures from surplus earnings amounting to $4,935,247.36. The present bonded indebtedness is $2,352,000. During the year $15,000 water bonds were purchased and canceled.

The sinking fund amounts to $705,-261.56, of which $702,475 is invested in city and county bonds, city tax certificates and park loans, and $2,786.56 is uninvested. The annual interest on the invested funds amounts to $27,836.50.

There are 8,909 meter accounts, an increase of 1,000 during the year. The total number of services is 22,234, an increase

of 1,315. The 1905 increase in service connections was the largest since 1890. In thirteen years the meter accounts have creased from 580 to 8,909.

During the year 38,419 feet or 7.2763 miles of new mains were laid. There are at present 276 miles and 922 feet of water mains, ranging from four inches to thirty-six inches in diameter, 2,587 fire hydrants, 2,375 valves and 373 street sprinkling hydrants. The superintendent recommends the laying of large mains in several of the streets for the purpose of giving better fire protection.

The report says that the rapid increase in the consumption of water admonishes the board that the present impounding facilities will be taxed to the utmost within a few years, and that the board cannot begin too soon to provide large storage capacity to meet the demands of a continued series of dry years.

The Public Ownership Commission.

The public ownership commission of the National Civic Federation met in New York City January 10, and made final arrangements for the investigation which it will undertake in this country and in Europe as to the comparative merits of public and private ownership of water supply, electric and gas lighting, and street railways. The commission decided to investigate plants in the various cities of this country. The subcommittee was named to employ the necessary engineers, accountants and other experts, not only for the investigation in this country, but in Europe. The work in America will begin February 1, and it is expected to reach London about May 1.

Those present at the meeting of the commission included Melville E. Ingalls, chairman, Cincinnati; Talcott Williams, Philadelphia; Walton Clark, Philadelphia; Edward W. Bemis, Cleveland; Professor John H. Gray, Northwestern University; Professor John R. Commons, University of Wisconsin; Professor Leo S. Rowe, University of Pennsylvania, and F. J. McNulty, president International Brotherhood of Electrical Workers, Washington.

Kansas City's Natural Gas Ordinance.

A decision was rendered by Judge H. L. McCune, in the circuit court at Kansas City, Mo., December 30, holding that there was no cause for charges of conspiracy recently filed against the city council, which threatened to pass over Mayor Neff's veto an ordinance granting a 30-year franchise to furnish the city with natural gas. The court issued a temporary restraining order, however, to keep the council from passing the ordinance in its present form, and from passing any ordinance containing an extension provision, which the court held to be illegal. The council had threatened to pass an ordinance granting a franchise to furnish natural gas. The ordinance covered a period of 30 years, but stipulated that in case the supply of natural gas gave out the company was to have the privilege of returning to the use of artificial gas. Judge McCune held this latter clause to be illegal.

The company already holds a 30-year franchise to sell artificial gas at $1 a thousand feet, and the new ordinance provided for 25-cent natural gas. Judge McCune gave the city council the right to pass an ordinance with the objectionable clause left out.

Proposed Improvements In New York City.

Among the many new public improvements contemplated in New York City during 1906 are the following: Breaking ground on the city's new $161,000,000 water system; building a new city lighting plant; erection of the first wing of the new $8,000,000 Bellevue Hospital; municipalization of the Thirty-ninth street ferry; construction of a dozen new modern docks of extra length; new $3,000,000 health building in Brooklyn; new $4,000,000 borough buildings in Brooklyn; new $4,000,000 terminal for the Brooklyn bridge; extension of shore road, Brooklyn, to cost $1,750,000; new playgrounds, at cost of $1,000,000; construction of underground passenger station at Manhattan end of Williamsburg bridge; building of Cross River reservoir; beginning of Flatbush avenue extension, to run from the Brooklyn terminal of the new Manhattan bridge to Fulton street and Flatbush avenuue; installation of new salt water fire service in the district below Twenty-third street. Besides these improvements many important undertakings have already begun.

Results of Municipal Lighting Plant at Wausau, Wis.

The first annual report since the installation of the municipal lighting plant at Wausau, Wis., has been submitted to the common council of that city. The Wausau Herald says of it:

Municipal ownership of the street lighting plant has made a showing in Wausau that must certainly please those who advocated or favored it and cause dismay in the ranks of its opponents. The first year's operation of the system closed on December 14, and the board of public works has figured the cost and will sub-

mit a detailed report to the council at its meeting next Tuesday evening.

This report shows that the total cost of the plant was $12,062.66. The cost of maintenance and repair was $190.80. The cost of electric current was $3,224.19. The salary of the electrician was $600. The total number of hours the lamps burned was 3,293, and the average number of lamps in use was 104½. The board figured 4 per cent. interest on the investment and 4 per cent. for depreciation of the plant and charged this up to the cost of operation. Almost all authorities on lighting plants figure but 3 per cent. depreciation, and this, too, when the power plant is included. Where only the distributing system (pole lines, wires and lamps) is considered it is a question whether any depreciation should be figured, because the keeping up and replacing of the system comes in under maintenance and repairs, and is going on from year to year. Because of the man in charge not knowing his business the lights were operated 253 hours and fifteen minutes over the prescribed time of 3,040 hours, which is the all dark night schedule, and this was done in the summer when the nights were short and there was no need of it whatever. This extra time the lamps burned cost the city $2.30 per lamp. Deducting this from the gross cost of $47.65 per lamp would leave the gross cost $45.35. The board finds the actual cash cost of operation to have been $38.42. This leaves interest and depreciation out of consideration. Taking $2.30 for overtime out of this would leave the actual cash cost for 3,040 hours but $36.12.

The cost of electric current per lamp was $30.86. Deducting $2.30 for overtime it would have been $28.56. The estimate of Jacob Cloos, the consulting engineer, was $29.36 per lamp for a system of 125 lamps. Mr. Cloos estimated that with a system of 125 lamps the total cost per year would be $44.85 per light. The results show Mr. Cloos was conservative and approximately correct in his estimates. If the plant had been operated but 3,040 hours the cost in each case would have been below his estimate.

The city had in operation an average of 104½ lamps during the past year. It now has 110 and beginning next month will have 125. This will bring the cost per lamp considerably lower, as the operating expense will be practically the same, aside from the electric current used, and the cost of installing the new lights will be very light for the reason that poles and wires are all up.

The board of public works says in closing its report that the saving to the city during the past year over the $55 contract offered by the Wausau Electric Company was $767.49, and the saving over the old contract of $80 per light was $3,379.99. The saving, figuring the actual cost to the city, was $965.12 over the $55 contract and $4,345.11 over the $80 contract.

Completion of Cincinnati Water-Works In Sight.

In his annual report to the waterworks commissioners, August Herrmann, president, declared that he new waterworks being constructed at Cincinnati will be ready to pump water to the high service districts by July 1, 1906, unless some unforseen emergency should occur. He says they will be able to supply at that time 25,000,000 gallons of water per day, over half of the present daily consumption of the city.

Knoxville Again Successful In Water Suit.

The United States supreme court rendered a decision January 2 in the case of the city of Knoxville, Tenn., and the Knoxville Water Company as to the right of the city to establish its own waterworks system. The decision was delivered by Justice Harlan, and was in favor of the city. The action originated in an effort by the water company to secure an injunction prohibiting the city of Knoxville from constructing waterworks of its own under an act passed by the Tennessee legislature in 1903, authorizing such action on the part of the city. The suit was based on a claim that the water company's rights were being violated, the company claiming the exclusive privilege of supplying water to the city until 1916 under a contract made in 1883. The claim was made, therefore, that the Tennessee statute was a violation of the clause in the constitution prohibiting the taking of property without due process of law and protecting contracts. The United States circuit court dismissed the bill, and the United States supreme court affirms this action.

The city water commission, with J. Allen Smith as chairman, has already begun action with a view to constructing municipal waterworks.

Waste of Water In Washington.

The waste of water and the taxing of the filtration plant to its utmost capacity caused the Medical Society of Washington, D. C., to appoint a committee to see what can be done toward checking the waste. The committee consists of Dr. G. Wythe Cook, Dr. W. T. Z. Sowers, Dr. George Koeber, Dr. Percy Hickling and Dr. Woodward. The committee's investigation so far indicates that Washington is one of the most wasteful cities in the world in its use of water. Also, that the filtration plant is quite satisfactory, but that the settling reservoirs are insufficient through many years of silting up. The committee thinks that the only and the obvious way to check the waste going on is to install water meters, so that if a man wastes water he will do it at his own expense.

Captain Cosby, engineer in charge of the filtration system, takes a more pronounced view of the situation than do the medical men. He says that immediate action is necessary to prevent the beds breaking down under the strain that will be thrown on them this winter, and that

passing unfiltered water into the mains, as may have to be done as an emergency measure, would be a positive calamity because Washington will run the risk of another typhoid epidemic.

Peoria's 75-cent Gas Rate Declared Unreasonable.

The United States supreme court handed down a decision, January 2, in the case of the Peoria Cas Company against the city of Peoria, Ill., holding that the ordinance fixing the rate of gas at 75 cents should not be in effect, as it was shown to be an unreasonable and unremunerative rate. The court held that, in the allegation of the city that the gas company had agreed with a competitor in business on a rate to be fixed, the duration or scope of such alleged agreement had not been shown. The decree against the gas company, therefore, was reversed and the case remanded for further examination relative to the alleged agreement.

Velocity of Flow of Underground Water.

The highest recorded velocity of underground waters has just been discovered by Mr. H. C. Wolff, of the department of mathematics of the University of Wisconsin, in the course of an investigation which he carried on in Arizona during the Christmas recess. The rate of movement of underground water in gravels near Tucson he found to be 144 feet in twnety-four hours, while the highest previously rated by observers was only about 100 feet. Mr. Wolff was commissioned by the chief hydrographer of the United States Geological Survey to spend the Christmas holiidays giving instructions to the members of the engineering department of the University of Arizona in the methods of measuring the rate of movement of under-flow streams. The University of Arizona is carrying on this work for the purpose of developing the water resources for irrigation in the neighborhood of Tucson.

Forestry for Engineers.

In consideration of the growing importance of the knowledge of forestry for engineers, as well as for farms, the University of Wisconsin has provided a new course in forestry to be given by State Forester F. H. Griffith. It is now generally recognized that an engineer should know something of forestry in dealing with the problems of irrigation, drainage, water supply and, most of all, water powers, whose value is dependent upon their being constant. The course will include protection of stream flow, water powers and water sheds, conservative lumbering, influences of forests on stream flow, dependence of great industries on forests, soil reclamation and reforestation of denuded lands.

Lecturers Appointed for College of Engineering, University of Wisconsin.

Following is the list of lecturers in the College of Engineering, University of Wisconsin, for the remainder of the current college year:

Mr. F. B. Wheeler, engineer of the Semet-Solvey Co., Syracuse, N. Y.,two lectures; subjects, "Gas Engineering." Mr. C. M. Davidson, chemist for C. & N. W. Railway; subject, "Purification of Water for Locomotive Boilers." Mr. J. M. Faithorn, president of the Chicago Terminal Transfer Co.; subject, "Regulation of Railroad Freight Rates." Mr. E. A. Behrend, chief engineer of Bullock Manufacturing Co.; subject, "High Speed in Modern Engineering." Mr. S. Wyer, consulting engineer, Columbus, O., two lectures; subjects, "Gas Producers" and "Producer Gas." Mr. L. R. Clauson, U. W. '97, signal engineer of C., M. & St. P. Ry. Co.; subject, "Railroad Signaling." Mr. Ralph Modjeski, consulting bridge engineer, Chicago; subject, "The New Thebes Bridge Over the Mississippi Near St. Louis." Mr. Arthur B. Wheeler, president of the Chicago Telephone Co.; subject, to be announced later. Prof. L. F. Breckenridge, College of Engineering, University of Illinois; subject, "The Use of Bituminous Coal in Boiler Furnaces." Mr. Andrews Allen, U. W. '91, construction engineer, Chicago; subject, "Engineering Construction." Mr. Frank W. Skinner, New York, has been appointed special lecturer in field engineering for the second semester in the present academic year.

United States Civil Service Examinations.

The civil service examinations to be held January 10 for stationary engineers in the Indian service was postponed until February 7, on account of the small number of applicants. The examination will be held at the government building, at Chicago, to fill vacancies in the San Carlos agency, Arizona, the agency at Puyallup, Wash., the Colorado river agency in Arizona, and at Grand Junction, Colo. The salaries range from $600 to $900 a year. Applicants are required to show a knowledge of grist mill and laundry machinery, experience in handling steam heating plants, and a knowledge of plumbing,

steam duplex pumps, engines, ice plant machinery, and the operation of an acetylene gas engine.

There will be an examination February 20 and 21, 1906, at the usual places, for draftsmen at $4 a day in the United States Surveyor General's offices, at Olympia, Wash.; Boise City, Ida., and Phoenix, Ariz.

Those wishing positions on the Panama canal should apply for information regarding examinations to the United States Civil Service Commission, Washington, D. C.

ORGANIZATIONS AND INDIVIDUALS

Northwestern Cement Products Association—Independent Asphalt Association—National Fire Protection—Indiana Engineering Society—Minnesota Engineers' Society—Register of the Milwaukee Convention of the N. A. C. U.—Exhibitors at the N. A. C. U. Acquittal of John W. Hill—Personal Notes.

Specifications for Hollow Blocks of the Northwestern Cement-Products Association.

The Northwestern Cement-Products Association, at its annual meeting, held at Minneapolis January 17, 18 and 19, adopted standard specifications for hollow blocks as follows:

Sand. — Such material as will pass through a screen ¼-inch mesh and is retained in screen having No. 40 mesh. This applies to river sand, bank sand or screenings from a stone crusher.

Gravel.—Such stone or rock, obtained either from a bank or river, of such size as is retained in a screen having ¼-inch mesh.

Crushed Stone. — Such stone from a crusher as is retained in a ¼-inch screen.

Bank Gravel.—Such material as is obtained from a pit or river containing both sand and gravel.

Aggregate.—Any material, such as broken stone, gravel or such fragments used with cement and sand mortar in making concrete for the purpose of reducing the cost and adding to the strength.

Voids.—The space existing between particles of sand, crushed stone or materials of which an aggregate is composed.

Cement. — Any American or Portland cement which will pass the tests required by the American Society for Testing Materials.

Quality of Sand.—Sand suitable for concrete work must not be finer than the above described must be sharp and gritty, not soft or loamy, must be free from loam or other foreign material and must not contain any perceptible amount of clay or other soluble matter. Some authorities concede that clay to the extent of 10 per cent. in sand or gravel is not harmful, but this committee is of the opinion that any perceptible amount of clay is unsafe. Crushed stone must be reasonably free from dust and must be retained on the same size screen as bank sand—viz., ¼ inch. Gravel or crushed stone must be free from loam, dust or other foreign material, and must contain no soft or rotten stone.

Determination of Amount of Cement to Be Used with Aggregate.—A theoretically correct concrete should consist of sand and gravel, or crushed stone, or a combination of them, containing an amount of cement equal to the voids in such combination. In other words, insterstices should be filled with cement.

To state this in another way, if the concrete is made up of sand and gravel, such proportion of cement should be used with the sand as is equal to the voids in the sand, and such quantity of this resulting mortar of sand and cement should be used with the crushed stone or gravel as will fill all voids in the crushed stone or gravel.

Restating this in a few words, the cement should fill the voids in the sand, and the resulting mortar should fill the voids in the aggregate.

Determination of Voids.—To determine the voids in the sand or the material to be used as an aggregate, what is known as the "water test" is employed. In preparing for this test the sand or gravel must be perfectly dry. Sand has greater volume when wet.

A receptacle holding a known amount, such as a quart jar, is filled with the material to be tested—sand, for example—and into this receptacle is poured as much water as the sand or other material will absorb. The water should be measured. The amount of water absorbed indicates the voids, and also indi-

cates the exact amount of cement which it is necessary to use in order to produce a solid concrete.

In making hollow blocks, if no gravel or other coarse aggregate is used, the result of this test should give the proportions of sand and cement to be used in block manufacture. Average sand will absorb 25 to 35 per cent. of water, indicating from 25 to 35 per cent. of voids; also indicating that the proportion to 1 part of cement to from 3 to 5 parts of sand are required to make a solid block.

The proper selection of sand and aggregate material is important. Care should be taken that the particles vary so in size as to reduce the voids to the smallest amount possible. With this careful selection the amount of cement required to produce good work is greatly reduced.

Provided that in defining the proportions of cement we mean that a given measure of cement is one portion and that multiples of that measure of aggregates as properly combined under the water test shall determine the proportion. If found under the test that 5 parts crushed stone or gravel will take 3 portions of sand to fill the voids without increasing the bulk, and that 1 portion of cement shall fill the remaining voids, this proportion shall be a 1 to 5 mixture.

Mixing.—After the materials are selected they should be mixed together dry until thoroughly incorporated, or, in other words, until the mass is of an absolutely uniform color. Water should then be applied and the thorough mixture repeated. The amount of water should be in all cases as great as possible without causing the materials to stick to the molds when the stone is removed.

A little more care in the treatment of the face plates of any machine will enable the manufacturer to use a wetter concrete than is usually employed. Only such size batches should be mixed at one time as can be used up within thirty minutes from the time the water has been added.

Manufacturing.—The concrete should be placed in the mold in small quantities, and tamping should begin immediately upon the placing of the first shovelful and continue until the mold is full. The material should be tamped with a tamper having a small face, and short, quick, sharp blows should be struck.

In faced blocks the face should be composed of 2 parts sand 1 part cement, the same being mixed in the manner described above.

Owing, however, to the excess of cement used in facing, and owing further to the fact that the cement is what makes concrete sticky, the facing cannot be used as wet as the balance of the block is made. Great care should be taken to tamp the concrete thoroughly into the facing, so as to unite the two into one solid stone.

In the wet process the amount of water is such as will produce a plastic or flowing condition in the concrete, but not enough to wash the cement from the other material. When placing the material in the molds the entire mold is filled with one pouring.

No stone having transverse ties or webs cracked should be used or even allowed to cure. Shrould a slight crack occur in moving the green stone throw the material back and make it over. In no case use a cracked stone in a building.

Curing.—All stone made by the medium wet or medium-dry process should be made under cover and kept under cover for at least ten days, protected from the dry currents of air. If shed room is not available to store a ten days' output the blocks should be carried out after the initial set has taken place and covered with canvas, hay or other covering that will retain moisture and at the same time keep the dry air from circulating around the block. Under no circumstances should blocks be made under the direct rays of the sun, nor should blocks made by this process be exposed to either sunshine or dry winds while curing.

The blocks should be gently sprinkled as soon as possible after making—that is, just as soon as the cement has set sufficiently that it will not wash. Blocks should be kept wet from ten days to two weeks, and should never be removed from the yard for the purpose of using in a building until they are from thirty to sixty days old. This is very important. A green block will surely crack in the building on account of shrinkage.

Laying.—In laying cement stone a soft mortar, composed of one-half cement mortar and one-half lime mortar, should be used. This mortar should be made with fine sand free from stone, and should be buttered on the ends of the stone before laying. The stone should be laid in the mortar and worked down. Do not leave end joints open until after the building is completed, because when the end joints are filled at this time shrinkage in mortar is liable to loosen it, causing the mortar to fall out, leaving openings through the wall.

The spreading of mortar is very important, because if mortar is unevenly spread so that it is thicker under one portion of the stone than under the other a leverage is created, which, under the weight of the wall, is liable to produce a crack in the stone.

Coloring.—In using coloring matter with concrete the color should always be mixed with the cement dry before any sand or water is added. This mixing should be thorough, so that the mixture is uniform in color. After this mixing the combination is treated in the same way as clear cement.

Among the papers submitted at the convention were the following: "Some of Our Troubles and How They Come About," Arthur N. Pierson, New York city; "Cement Piles," Henry Longcope, of Philadelphia; "Reinforced Concrete Construction," C. A. P. Turner; "The Concrete Block Industry of the Future as Indicated by Past Experience," A. P. Melton, of Minneapolis. A. G. Peterson, of Wahpeton, N. D., in speaking of sidewalk building, advocated thorough mixing of gravel with a richer amount of cement in the base and less in the face than has been the custom. He stated that he had successfully laid sidewalks right on the ground without heaving. He warned against taking village contracts payable in warrants without a definite statement as to from what fund the warrants were to be paid, and preferably from the general fund. He advised the use of tar paper between a walk and a stone wall, or the cement will unite with the wall and will result in breaks in the walk. He lays cement walks with a center seam, and packs hard on the sides. The frost

raises the walk in the center, which afterward settles back. He said expansion joints were necessary in a string of walks 100 feet long or more.

Officers for the ensuing year were elected as follows: President, C. A. P. Turner, Minneapolis. Vice-presidents: Cement and aggregate section, A. H. Laughlin, Lisbon, N. D.; machine and equipment section, O. U. Miracle, Minneapolis; cement section, Lee Stover, Watertown, S. D.; concrete other than blocks, John Wunder, Minneapolis; engineers and architects, E. W. Dow, Sioux Falls, S. D.

C. A. P. Turner, Lee Stover, L. L. Bingham, Mr. McCormick and John Wunder were appointed a commitete to arrange for an official organ, a paper representing concrete solely.

Independent Asphalt Association.

Representatives of twenty-seven asphalt paving companies and firms, operating in various cities of the United States and Canada, met in New York on January 17 and effected an organization under the name of the Independent Asphalt Association. The objects of the association, as set forth in the articles of association, are "for the purpose of discussing the various questions of interest to the industry arising from time to time, and to exchange views as to the best method of extending and developing the business, improving the quality of asphalt pavements and to do all things incidental and conducive to the attainment of the above objects."

All reputable firms and companies engaged in the production of asphalts and in the laying of pavements, who are in sympathy with the objects for which the association has been formed, are eligible for membership.

The following contractors were represented, all of whom became charter members of the association:

W. N. Andrews, Hamilton, O.; the A. L. Barber Asphalt Co., New York; Brennan Construction Co., Washington, D. C.; Constructing and Paving Co., Toronto; Cleveland Trinidad Paving Co., Cleveland, O.; Continental Asphalt Paving Co., New York; Costello & Neagle, Elmira, N. Y.; Henry Dumary, Albany, N. Y.; Cranford Company, Brooklyn, N. Y.; Cranford Paving Co., Washington, D. C.; Eastern Bermudez Asphalt Paving Co., Brooklyn; Isaac S. Filbert, Baltimore, Md.; Filbert Paving and Construction Co., Philadelphia, Pa.; German Rock Asphalt and Cement Co., Buffalo, N. Y.; Harlem Contracting Co., New York; The A. Jaicks Co., Chicago, Ill.; Kirchner Construction Co., Cincinnati, O.; John R. Lee, Paterson, N. J.; Mayer Bros., Erie, Pa.; Hugh Murphy, Omaha, Neb.; Parker-Washington Co., St. Louis, Mo.; Scully Paving Co., Chicago, Ill.; Sicilian Asphalt Paving Co., New York; E. W. Sutphen, Buenos Ayres, S. A.; Warner-Quinlan Asphalt Co., Syracuse, N. Y.; Uvalde Asphalt Paving Co., New York; R. D. Upham, New York.

Letters expressing sympathy with the purposes of the Association and a desire to co-operate with the movement were read from the following contractors:

Western Construction Co., Lafayette, Ind.; Southern Paving and Construction Co., Chattanooga, Tenn.; Memphis Asphalt and Paving Co., Memphis, Tenn.; Booth & Flinn, Pittsburg, Pa.; Southern New England Paving Co., Hartford, Conn.; Narragansett Improvement Co., Providence, R. I.; The Independent Asphalt Paving Co., Tacoma, Wash., and Messrs. H. P. Pennock & Co., Winnipeg, Man.

It is probable that these and other asphalt contractors will become members of the association.

After the business meting the association held its first annual banquet at the Hotel Astor.

The officers elected to manage the affairs of the association for the first year are as follows:

President, A. L. Barber, New York; first vice-president, W. H. Kinch, Buffalo, N. Y.; second vice-president, David McCormick, Chicago, Ill.; treasurer, R. T. Rokeby, New York; secretary, P. W. Henry, 17 Battery Place, New York.

Executive committee: Gen. Howard Carroll, New York; P. P. Brennan, Washington; James Pearson, Toronto, Can.; John H. Gleason, Troy, N. Y.; Andrew Jaicks, Chicago, Ill.; P. R. Quinlan, Syracuse, N. Y.; R. T. Rokeby, New York city; Frank H. Kirchner, Cincinnati, O.; W. V. Cranford, Brooklyn, N. Y.; Hugh Murphy, Omaha, Neb.; M. F. Bramley, Cleveland, O.; R. Y. Filbert, Philadelphia, Pa.

National Fire Protection Association Meeting.

The tenth annual meeting of the National Fire Protection Association, which is to be held in Chicago May 22 to 24, promises to prove notable in the history of that active and progressive organization. In addition to the usual programme covering discussion and adoption of rules and specifications covering fire-protection topics the tenth anniversary is to be marked by a commemorative address on the organization, aims and purposes of the association, to be delivered by Uberto C. Crosby, United States manager of the Royal Exchange Assurance, who is one of the founders of the association, its only honorary life member and who has been identified with fire-protection work covering a longer period than is represented by the history of the organization. An additional feature of interest in connection with the meeting will be the demonstration to be given in the new testing station of the Underwriters' Laboratories.

The Indiana Engineering Society.

The annual convention of the Indiana Engineering Society was held in Indianapolis January 18, 19 and 20, and was the most successful the society has ever held. Largely through the efforts of President R. P. Woods over forty new members were added to the society, and there were fully seventy members in attendance. The programme was carried out as given in late numbers of MUNICIPAL ENGINEERING, and the new feature, the banquet, was voted an unquestioned success, with sixty-seven in attendance. Over seventy were on the special cars furnished by the Indianapolis & Cincinnati electric line for the trip to Rushville to inspect the high-tension system in operation on this line

The officers elected were Robert P. Woods, Indianapolis, as president; E. E. Watts, Princeton, as vice-president; Chas. C. Brown, Indianapolis, as secretary, and B. F. Nesbit and W. F. M. Goss as directors.

The Minnesota Surveyors' and Engineers' Society.

At the annual meeting of the Minnesota Surveyors' and Engineers' Society, held in the city of St. Paul on the 28th inst., some thirty were present. O. H. Case, county surveyor of Fillmore county, read a paper on "The County Surveyor;" Geo. W. Cooley, secretary of the State Highway Commission, gave a short address on "The Good-Roads Movement;" Chas. A. Forbes, county surveyor of Dakota county, read a paper on "Some of the Conditions Confronting the Highway Commission;" C. A. P. Turner, consulting engineer, Minneapolis, read one of his interesting papers on "Reinforced Concrete;" L. P. Wolff, consulting engineer, St. Paul, delivered a discourse on "Sewage Disposal," which was accompanied by many plans of septic tanks and filters now in the course of construction in some of the towns of North Dakota and Minnesota. He was followed by Dr. H. M. Bracken, of the State Board of Health, who outlined the requirements of the board relative to the same subject. John Abercrombie, chief engineer of the State Topographical Survey, read a paper outlining the work already done by this survey and some of the difficulties that had to be overcome. Geo. W. Sublette, consulting engineer, Minneapolis, read a very interesting and instructive paper on the important subject of "Foundations."

The following are the new officers: President, J. S. Hill, St. Cloud, Minn.; vice-president, C. W. Gove, Windom, Minn.; secretary and treasurer, Arthur E. Morgan, St. Cloud, Minn.

Register of the Milwaukee Convention N. A. C. U.

The following is an alphabetical list of the individuals and firms represented at the Milwaukee convention of the National Association of Cement Users. The delegates of members and visitors are listed under the names of their respective firms:

Akron Artificial Stone and Construction Co., Akron, N. Y.
F. M. Jackson.

Alpha Portland Cement Co., Easton, Pa.
Henry Longcope, Philadelphia, Pa.

Alton Roofing, Artificial Stone and Supply Co., Alton, Ill.
H. Luer, secretary.
E. J. Ash, manager.

American Carpenter and Builder, Chicago, Ill.
H. E. Trams.
O. F. Bybee.
Wm. Renther.

American Cement Co., 101 Milk street, Boston, Mass.
E. S. Larned.

American Hydraulic Stone Co., Denver, Col.
Will J. Scoutt, Chicago, Ill.

American Tile and Artificial Stone Co., Americus, Ga.
O. P. Wallis.

Anchor Concrete Stone Co., 312 Main st., Rock Rapids, Ia.
Chas. W. Bradley.

John Anderes, Wausau, Wis.

E. F. Arnt, Barnett street, Kansas City, Kan.

Art Building Block Machinery Co., 119 Liberty st., Jackson, Mich.
A. M. Haight.

The Art Stone Supply Co.
J. L. Nutter.
C. A. Nutter.

Atlanta Concrete Mfg. and Const. Co.
J. N. Brown, president.
S. C. Arkens.

Atlas Portland Cement Co., 30 Broad st., New York city.
Thos. M. McGiff.
J. L. Austin.
Geo. C. Ehlers.
O. J. Schoeneciar.
B. L. Swett.
D. P. Pierson.

Automatic Building Block Machine Co., 119-121 Liberty st., Jackson, Mich.
W. T. Smith.
J. Hunter.
L. McGowan.
L. H. Scott.
C. F. Scott.
R. Schullnany.
P. M. Wolf.
M. J. McGowan, Avoca, Pa.

Joseph Babiczky, Guardian Trust Bldg., Kansas City, Mo.

Badger Cement Stone Co., 111 Mason street, Milwaukee, Wis.

W. W. Bailey, Chadwick, Ill.

Barker & Nighswander, Jefferson ave. and Water st., Toledo, O.
Dr. W. S. Barker.
C. F. Nighswander.
W. W. Barker.

J. L. H. Barr, Batavia, O.

Battjes Fuel and Building Material Co., Grand Rapids, Mich.
Nicholas Battjes.
Frank Battjes.

H. W. Bedell, Bloomfield, Ont.

H. Becker, Grand ave., Milwaukee, Wis.

W. & H. Beirer, 813 E. Sixth st., Alton, Ill.
Henry Beirer.
W. C. Beirer, president.
E. C. Mack.
Wm. Bell, 509 Hill ave., Elgin, Ill.
Bellevue Stone Co., Bellevue, O.
T. E. Wyant, Bellevue, O.
E. E. Benner, Sargent, Neb.
W. C. Bensemann, 31 Hathaway Bldg., Milwaukee, Wis.
Berthelet Construction Co., Milwaukee, Wis.
Aug. Luengemann.
Bert Perrigo.
Chas. Buckwiller.
C. V. Koch.
N. A. Christiansen.
B. K. Miller.
R. Hartman.
S. E. Czerwinski.
Thos. E. Haye.
C. L. Fortier.
A. Ellefson, 717 Garfield ave., Ft. Smith, Ark.
Geo. S. Bartlett.
J. R. Berthelet.
V. E. Berthelet.
Wm. T. Berthelet.
Walter Burke.
The Besser Mfg. Co., Alpena, Mich.
J. H. Besser.
Wm. Hurley, 426 Marietta st., Buffalo, N. Y.
A. C. Birnie, Ludlow, Mass.
Blanc Stainless Cement Co., 1 Madison ave., New York city.
Jas. Maxwell Carrere.
J. M. Blakely, 541 Union st., Centralia, Ill.
Blaw's Collapsible Steel Centering Co., 1414 Penn. ave., Pittsburg, Pa.
Jacob B. Blaw, president.
R. J. & W. M. Boyd Construction Co., Kansas City, Mo.
W. M. Boyd.
Fred G. Boyden, Bradford, Ill.
C. W. Boynton, 1057 Rookery, Chicago, Ill.
H. T. Boyden Builders' Supply Co., Buckhannon, W. Va.
A. E. Bradshaw.
Brillion Concrete Works, Brillion, Wis.
John Koche.
Chas. Carroll Brown, secretary, Commercial Club Bldg., Indianapolis, Ind.
W. A. Bruce, 3161 Northwestern ave., Indianapolis, Ind.
John Buehler, Perley, Wis.
Burnham Brick Co., Jackson st., Milwaukee, Wis.
W. J. Morgan.
Buser Concrete Construction Co., Mt. Morris, Ill.
John F. Burnham.
N. E. Buser.
R. E. Buser.
Edward T. Cairns, 169 LaSalle st., Chicago, Ill.
Capital City Concrete Construction Co., 214½ S. Sixth st., Springfield, Ill.
P. E. Taintor.
L. E. Lawson.
C. H. Carlon, 910 First ave., E. Oskaloosa, Ia.
C. H. Carter, Peotone, Ill.
Castalia Portland Cement Co., 209 Ninth st., Pittsburg, Pa.
Chas. L. Johnson.
Cement Brick Co., Port Huron, Mich.
B. S. Roberts.
Cement Construction Co., Terre Haute, Ind.
W. R. Kennedy.
Cement and Engineering News, 224 La Salle st., Chicago, Ill.
Wm. Seafert.
Cement Machinery Co., Jackson, Mich.
S. L. Wiltse.
Cement Machinery Mfg. Co., Burlington, Ia.
J. W. Sanderson.
W. F. Roney.
C. B. Foster.
W. S. Farrar.
Chas. E. Niend.
Cement Pressed Brick Co., Benton Harbor, Mich.
J. D. Luttrell.
Cement Stone and Supply Co., Wichita, Kan.
I. F. West.
Century Cement Machine Co., 181 W. Main st., Rochester, N. Y.
A. T. Bradley.
Ely Roberts.
Lewis Kuster.
George Abbott.
C. R. Lehrack.
O. D. Tiffany.
Robert Siebert.
W. O. Williams.
John N. Rauber.
Charleston Building Block Co., Charleston, W. Va.
L. B. LeRoy.
The Chase Foundry and Mfg. Co., Columbus, O.
S. M. Chase.
Chicago Portland Cement Co., Chicago, Ill.
J. W. Woodruff.
D. D. Drummond.
W. F. Main.
J. U. C. McDaniel.
Chicago Pneumatic Tool Co., Chicago, Ill.
Chas. V. Walker.
Chickamauga Cement Co., Chattanooga, Tenn.
W. P. D. Moross.
City Construction Co., Milwaukee, Wis.
James O'Connor.
John S. O'Neil.
Clyde Clark, N. Lake st., Warsaw, Ind.
Fred S. Clark, N. Lake st., Warsaw, Ind.
Geo. W. Clark, Wausau, Wis.
J. W. Clark, 527 S. Elm st., Centralia, Ill.
The Cleveland Car Co., West Park, O.
W. H. Caskey, Cleveland, O.
R. W. Russell.
Coltrin Mfg. Co.
Geo. Merrill.
C. C. Helling.
P. P. Comoll, Sioux City, Ia.
Concrete Building Block Co., Badger ave., Newark, N. J.
J. H. Twitchell, superintendent.
Concrete Construction Co., John Edelman, Mgr., Muskegon, Mich.
Gus Mosweck.
C. Vandesande.
T. J. McGrath.
Concrete Construction Co., Rock Island, Ill.
C. E. Bryan.
Concrete Sand and Stone Co., Youngstown, O.
A. A. Pauly.
Clews & Co., South Bend, Ind.
T. Beham.
W. H. Black.
Consolidated Litholite Co., Saratoga Spgs., N. Y.
David B. Ledlie.
"Construction News," Chicago, Ill.
E. S. Hanson.
Contractors' Supply and Equipment Co., Van Buren and Dearborn sts., Chicago.
John F. Pearce.
F. B. Wright.
John Treyor.
C. D. Corey, 626 Elm st., Rockford, Ill.
J. W. Cotter, 617 State st., Appleton, Wis.

Crescent Cement Block Mfg. Co., Deshler, O.
C. L. Catherman, Elkhart, Ind.
E. H. Crowell, Crown Point, Ind.
Cunningham Bros., Brook, Ind.
W. S. Cunningham.
R. E. Cunningham.
Cummings Structural Concrete Co., 4 Smithfield st., Pittsburg, Pa.
Robert A. Cummings.
Thomas Darcey, Watertown, Wis.
Lou Davis.
Geo. W. De Smet, 317 Chamber of Commerce Bldg., Chicago, Ill.
Dever Cement Tank and Silo Co., Cassopolis, Mich.
O. A. Dever.
E. K. Black.
Dexter Portland Cement Co., Nazareth, Pa.
Richard K. Meade.
Diamond Cement Machine Co., Deshler, O.
S. A. Jones.
David Hospins.
Chas. W. Diener Cement Products Co., Burlington, Wis.
C. Herman Dorner, 1922 Cedar st., Milwaukee, Wis.
W. J. Donahue & Co., 402 Free Press Bldg., Milwaukee.
Chas. Donnelly, 481 Cass st., Milwaukee.
S. J. Dowling.
Oswall A. Dreman, Waukesha, Wis.
S. L. Dunlap, Park ave., Indianapolis, Ind.
The Durolithic Co., Buffalo, N. Y.
Geo. F. Fisher.
W. W. Wade.
The Dykema Co., 939 Michigan Trust Bldg., Grand Rapids, Mich.
F. L. Dykema.
A. K. Early, Rock Fall, Ill.
Eastern Concrete Machinery Supply Co., Akron, N. Y.
J. R. Thomas.
Easy Block Handlers, Appleton, Wis.
John Driscoll.
M. K. Gochnauer.
Eau Claire Concrete Co., Farwell and Maine sts., Eau Claire, Wis.
Geo. W. Robertson.
J. W. Ross, president.
Edison Portland Cement Co., Pittsburg, Pa.
G. B. Nutt.
The Edmondson Machine Co., South Bend, Ind.
J. H. Willeg, Plymouth, Ind.
The T. O. Eichelberger Co., Dayton, O.
J. W. Popenoe.
T. O. Eichelberger.
H. A. Schlick.
Wm. Hughes.
J. C. Collett.
Harry Eickemeyer, 417 S. Madison st., Bay City, Mich.
Henry Eilers, Burlington, Ia.
Elmhurst-Chicago Stone Co., Elmhurst, Ill.
Wm. Hammerschmidt.
R. Hammerschmidt.
Elyria Lumber and Coal Co., Elyria, O.
H. B. Hecock.
Elyria Plaster Co., Elgin, O.
W. S. Griswold.
Eureka Machine Co.
H. F. Abbott.
Evanston Hydraulic Stone Co., 1580 Sherman ave., Evanston, Ill.
F. H. Gill.
J. P. English.
Jas. Wigginton, Jr.
Tom J. Foley.
H. M. Lavers.
Robt. Gill, 2798 N. 47th ave., Chicago.
C. H. Bartlett.
D. McCann.
E. F. Facemire, Edinburg, Ind.
Fairbanks, Morse & Co., 134 Sycamore st., Milwaukee, Wis.
C. L. Dane.
Jas. J. Farley, Farley & Co., Homer, Ill.
C. J. Farrar, Emerson ave., Crafton, O.
Ed Fennelly, Ashland, Wis.
W. H. Fisher.
J. J. Flanders, Glenco, Ill.
Flint Stone Co., 202 National ave., Toledo, O.
F. K. Hogue.
Wm. Fleury.
Ft. Wayne Cement Stone Co., 2027 Nelson st., Ft. Wayne, Ind.
L. Chas. Jacquel.
J. B. Frahm Fuel and Construction Co., 304 Harrison st., Davenport, Ia.
J. B. Frahm.
B. C. Frahm.
Freeport Concrete Construction Co., 111 Spring st., Freeport, Ill.
Fremont Concrete Stone Co., Fremont, Neb., A. M. Helt, mgr.
Gus Frey, 829 First st., Milwaukee, Wis.
J. A. Fried, Lincoln, Neb.
F. M. Frost & Sons, Jerseyville, Ill.
A. C. Fuge, West Bend, Wis.
J. Fuhreman & Son, Osnaburg, Wis.
Jacob Fuhreman, Jr.
Jacob Fuhreman.
Fulton County Supply Co., 105½ N. Pryor st., Atlanta, Ga.
J. L. Clark, manager.
S. J. Gammon, Citizens' Bank, Norfolk, Va.
W. J. Genthner, Dispatch, N. Y.
W. H. Gilbert, Olney, Ill.
Con. Gminer, Waupaca, Wis.
L. M. Goddard, La Crosse, Wis.
Fred Goepper, 429 N. Holmes ave., Indianapolis, Ind.
N. E. Good, 165 Center st., Ashtabula, O.
F. R. Goodrich, Traverse City, Mich.
Howard G. Goodwin, 281 W. Market st., Akron, Wis.
Graham Construction Co., 406 Free Press Bldg., Milwaukee, Wis.
James Graham.
W. J. Graham.
Granite City Lime and Cement Co., Granite City, Ill.
A. H. Eisenmenger.
H. M. Hack, Kankakee, Ill.
Mrs. S. Hackey, 305 Fourth st., Milwaukee, Wis.
A. M. Haight.
Elisha Hall, Princeton, Wis.
Jas. P. Hall, foot Henderson st., Jersey City, N. J.
Hannaford Cooperstown Concrete Co., Hannaford, N. D.
S. H. Berg.
Wm. Hanner, 81 Fourth ave., Beloit, Wis.
D. N. Harper, 54 Home Bank Bldg., Detroit, Mich.
Chas. Harriman, 12 Odell ave., Yonkers, N. Y.
J. R. Harrington, Edinburg, Ill.
C. L. Harris & Son, Sargent, Neb.
Hartwick Machinery Co., Washington st., E. Jackson, Mich.
Geo. D. Scheiffler.
Mrs. Scheiffler.
J. W. Hartwick.
Geo. Scheiffler.
H. E. Haskins, Lake Geneva, Wis.
The Hayden Automatic Block Machine Co., 112 W. Broad st., Columbus, O.
C. E. Ottman.
Kirk H. Brown.
B. F. Hayes & Co., Liberty, Mo.
A. Heep, 651 Eighth st., Milwaukee.
Helm Brick Machine Co., Traverse City, Mich.
E. S. Williams.
"Engineering Record," New York.
S. T. Henry.

S. W. Hoffman, Zanesville, O.
Mrs. F. K. Hogue.
D. C. Holloway, Lombard, Ill.
Geo. J. Hommel, American Express Co., Milwaukee, Wis.
Hoosier Cement Post Machine Co. and Ideal Cement Post Co., Elkhart, Ind.
C. L. Catherman.
Hot Springs Concrete Co., Hot Springs, Ark.
W. S. Sorrells, president.
C. E. Marks, manager.
Hotchkiss Concrete Stone Co., 315 Dearborn st., Chicago, Ill.
Wm. S. Hotchkiss.
E. S. Hotchkiss, Chicago, Ill.
Richard L. Humphrey, president, 1001 Harrison Bldg., Philadelphia, Pa.
Lora P. Hutto, Sharpsville, Ind.
Ideal Cement Block Machine Co., South Bend, Ind.
J. W. Cooper, Minneapolis, Minn.
C. D. Higgins, Aberdeen, S. D.
Mentor Wetzstein.
W. Stewart, Antigo, Wis.
P. F. Tall, 3172 N. Capitol ave., Indianapolis, Ind.
F. A. Borst.
F. Schnurr.
S. L. Kelly.
G. B. Pulfer.
F. J. Fitzsimmons.
D. M. Click.
Indestructible Post Co., Chicago, Ill.
Illinois Gravel Co., Princeton, Ill.
L. H. Scott.
C. F. Scott.
Illinois Steel Co., Cement Dept., Rookery, Chicago, Ill.
Henry S. Backus, Chicago, Ill.
B. H. Rader.
J. C. Van Dorn, Odd Fellows' Bldg., St. Louis, Mo.
Iowa Building Block Machine Co., Waterloo, Ia.
H. L. Green.
J. L. Shannon.
Samuel Isely, Monroe, Wis.
The Jaeger Machine Co., 313 W. Broad st., Columbus, O.
G. Jaeger.
C. C. Jacobs, Wauwatosa, Wis.
Jacksonville Sand-Cement Brick Co., Jacksonville, Ill.
W. H. Cocking.
Otto Hoffman.
Jansen & Zreller, Pekin, Ill.
Honore J. Jaxon, 681 W. Lake st., Chicago, Ill.
J. L. Johnson, West Union, Ia.
H. N. Jones, Houston, Tex.
The Kakiat Co., Suffern, N. Y.
M. S. Daniels.
M. Kammerer, Fairbury, Ill.
Kankakee Artificial Stone Co., 224 Court st., Kankakee, Ill.
H. O. Van Meter.
John Devere.
Kelley Island Lime and Transportation Co., Cleveland, O.
Geo. P. Schwab.
Kennedy & Berry, Detroit, Mich.
Horace G. Smith.
Kennedy & Lowry, 38 Congress st., Detroit, Mich.
C. L. Lowry.
D. M. Kennedy.
Chas. W. Kenney, 2353 W. Jackson st., Chicago, Ill.
E. Kenney, 432 W. Lucas st., Creston, Ia.
Keune Bros., Hika, Wis.
Wm. A. Keune.
Kimpel Land Co., 239 Third st., Milwaukee, Wis.
W. A. Kimpel.
Ella King, Milwaukee, Wis.
Miss J. Kirchoff, Milwaukee, Wis.
Knickerbocker Co., Jackson, Mich.
R. B. Coltrin.
C. J. Kramer, 277 Thirty-fourth st., Milwaukee, Wis.
B. K. Kramer, 225 Main st., Lafayette, Ind.
P. O. Krottnauer, 226 La Salle st., Chicago, Ill.
Lamb & Rutledge, Newark, O.
John P. Lamb.
Jos. W. Rutledge.
C. E. Lander, Viroqua, Wis.
R. H. Lathers, 524 Baker st., Detroit, Mich.
Nick Lauer, Ottoville, O.
James F. Lee & Son, 207 W. Locust st., Dubuque, Ia.
T. M. Le Hew & Son, Warsaw, Ind.
T. M. Le Hew.
John N. Le Hew.
Lehigh Portland Cement Co., Allentown, Pa.
C. F. O'Neill.
C. A. Matcham.
T. E. Paulson, Indianapolis, Ind.
L. R. Leppler, 185 Dearborn st., Chicago, Ill.
Robt. W. Lesley, Pennsylvania Bldg., Philadelphia, Pa.
W. A. Lewis, 182 Wisconsin st., Milwaukee, Wis.
Licking Artificial Stone and Construction Co., Newark, O.
Wm. Chambers, Garden City Sand Co., Chicago, Ill.
Lillibridge & Anderson, St. Charles, Ill.
C. A. Anderson.
W. P. Lillibridge.
Lima Artificial Stone Co., Lima, O.
Val Heil.
Ch. Tinnier.
John Locher.
Little Rock Artificial Stone Co., Little Rock, Ark.
D. G. Taylor.
Herman Loeffel, Cape Girardeau, Mo.
Long Island Concrete Building Block Co., Bayside, N. Y.
Geo. J. Hamill.
Wm. Lough, Arcola, Ill.
M. N. Lovewell, Chicago, Ill.
Geo. H. Lowe, Arlington, Mass.
Elmer Lower, Rochelle, Ill.
W. H. Lucas, 187 Buckingham st., Newark, O.
C. E. Lupton, 150 Franklin st., Harrisonburg, Va.
A. D. Mackay & Co., Chicago, Ill.
A. D. Mackay.
Chas. Ellis Malig, 758 Third st., Milwaukee, Wis.
Mandt-Powell Concrete Machinery Co., Stoughton, Wis.
O. G. Mandt.
M. G. Mandt.
P. H. Brewster, mfr. of bldg. block machinery, 830 Collett ave., Terre Haute, Ind.
"Manufacturers' Record" Publishing Co., Baltimore, Md.
John Glass, Western representative.
Marquette Cement Mfg. Co., Chicago, Ill.
John A. Dunlap.
Wm. Dickinson.
Robert B. Dickinson.
John W. Dickinson.
F. F. Martin & Co., Goodwin Blk., Beloit, Wis.
F. F. Martin.
Matthews Bldg., Milwaukee, Wis.
S. D. Austin.
F. K. Mayne, Blue Springs, Neb.
C. W. Menefee, Thomas st., Ft. Wayne, Ind.
Metropolitan Stone Co., 1 Madison ave., New York city.
Edward R. Diggs.

P. C. McArdle, 797 W. Van Buren st., Chicago, Ill.
John McBride, 545 Chicago st., Elgin, Ill.
D. McDonald, 616 Michigan st., Petosky, Mich.
McGinnis & Whitlock, Indiana st., Terre Haute, Ind.
E. W. Whitlock.
W. O. McKinny, Piper City.
McLaughlen-Mateer Co., Kankakee, Ill.
W. S. McLaughlen.
C. E. Mateer.
John McNary, Canonsburg, Pa.
Meacham & Wright Co., 921 Chamber of Commerce Bldg., Chicago, Ill.
Chas. G. Reid.
Wm. Millen, 2825 W. First st., Duluth, Minn.
Rudolph P. Miller, 141 E. Fortieth st., New York city.
Milwaukee Concrete and Suply Co., Milwaukee, Wis.
J. F. Lockley, agt. Newaygo Portland Cement Co., Grand Rapids, Mich.
J. S. Sanborn.
Frank Ehlert.
M. Dix.
W. L. Stimple.
C. Hanson, architect.
G. W. Burr.
G. Becher.
Bert Perigo.
Mr. Bond.
Mr. Lauman.
Mr. Hahn.
Geo. Burridge.
Wm. Chambers, Niles, Wis.
Robert Higgs, Niles, Wis.
Art. F. Partridge, Niles, Wis.
Miracle Pressed Stone Co., Minneapolis, Minn.
O. W. Miracle.
J. D. Mitchell, 44 Lombard Bldg., Indianapolis, Ind.
Modern Construction Co., 110 Mason st., Milwaukee, Wis.
O. B. Hutchens.
R. E. Hutchens.
A. W. Friske.
John Molitor, architect, 160 Washington st., Chicago, Ill.
A. Monsted & Co., Milwaukee, Wis.
H. C. Fuldner.
A. Monsted.
Geo. B. Moogk, Waterloo, Ont.
Morriss Construction Co., Granite City, Ill.
A. W. Morriss.
R. A. Morriss.
Albert Moyer, Flat Iron Bldg., New York city.
MUNICIPAL ENGINEERING Co., Commercial Club Bldg., Indianapolis, Ind.
W. P. Cosgrove.
F. T. Randall.
William Fortune.
Chas. C. Brown.
Municipal Engineering and Construction Co., Chicago, Ill.
Herman Uesling, Winthrop Harbor, Ill.
Omer Brandon, 5644 University ave., Indianapolis, Ind.
C. E. Bathrick.
T. M. Meek.
W. M. Munson, Jr., Mitchell, Ind.
Samuel Munnel, Canonsburg, Pa.
"National Builder," 358 Dearborn st., Chicago, Ill.
E. B. Hoy.
Geo. A. Faigher.
National Building Block Co., 211 Grand ave., Milwaukee, Wis.
Wm. Bannen.
J. P. Sherer.
F. W. Hadfield.
H. T. Behrle, 629 Mock ave., Detroit, Mich.
T. B. Whitnall.
National Concrete Construction Co., Board of Trade Bldg., Louisville, Ky.
Webster Gagley.
Jas. B. Wilson, 324 Dearborn st., Chicago, Ill.
Neck Bros., Montello, Wis.
B. Neck.
George Nees, Wellington, Ont.
W. P. Nees, Wellington, Ont.
Neola Cement Block and Construction Co., Neola, Ia.
J. H. Cupp.
Chas. F. Nesbit, Dixon, Ill.
New Castle Artificial Stone Co., New Castle, Pa.
W. P. Hanna.
New Jersey Cement Stone Co., 89 Dodd st., East Orange, N. J.
J. W. Pierson.
The Newark Artificial Stone and Plaster Co., N. Williams st., Newark, O.
John McNamara.
The New Way Motor Co., Lansing, Mich.
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C. L. Merfenry.
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A. N. Fairchild, 643 Shepard ave., Milwaukee, Wis.
Nice-Rasor Co., Barberton, O.
W. H. Nice.
O. O. Rasor.
Northwestern Expanded Metal Co., 190 Old Colony Bldg., Chicago, Ill.
Geo. Roden.
Northwestern Steel and Iron Works, 1214 First ave., Eau Claire, Wis.
Northwestern Tile Co., Grand ave., Milwaukee, Wis.
Mr. Cutter.
Mr. Dolman.
Mr. Sivyer.
Wm. Durnthy.
Norwood Concrete Block Co., Hyde Park, Cincinnati, O.
H. M. Ormsby.
Arthur W. O'Keefe, Plymouth, Ind.
Edwin Osgood, 205 N. Euclid ave., Oak Park, Ill.
Oshkosh Concrete Construction Co., Oshkosh, Wis.
Eli Defuet.
Palmer Concrete Hollow Block Co., 40 N. Delaware st., Indianapolis, Ind.
C. F. Childer.
Harmon S. Palmer Hollow Concrete Building Block Co., 1450 Girard st., Washington, D. C.
Harmon S. Palmer.
J. D. Wood.
H. H. Swan.
R. J. Schwab, Milwaukee, Wis.
Pandora Cement Block Co., Pandora, O.
Fred Gratz.
Parkersburg Artificial Stone Co., 410 George st., Parkersburg, W. Va.
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Peerless Brick Machine Co., 100 Lumber Exchange, Minneapolis, Minn.
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Pennsylvania Cement Co., 26 Cortlandt st., New York, N. Y.
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Perfection Block Machine Co., 501 Kasota Blk., Minneapolis, Minn.
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The Phillips Cement Stone Co., 705 Oakwood ave., Columbus, O.
Phillips Lime and Coal Co., Burlington, Ia.
P. H. Phillips.
Arthur N. Pierson, 1 Park row, New York.
Piqua Artificial Stone Co., Wood st., Piqua, O.
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C. J. Poetsch, city engineer, Milwaukee, Wis.
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Power and Mining Machinery Co., Cudahy, Wis.
F. C. Dunham.
Practical Cement Block Co., 23 E. Market st., Indianapolis, Ind.
A. E. Bradshaw.
Robt. F. Prengel, 881 Humboldt ave., Milwaukee.
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W. J. Hobbs.
H. S. Quick, 725 Lemcke Bldg., Indianapolis, Ind.
Reading Brick Machinery Co., 405 Baer Bldg., Reading, Pa.
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Ricketson Mineral Paint Works, 407 Broadway, Milwaukee, Wis.
Wm. Pfleger.
J. Frey.
Riesen & Wilke, 970 First st., Milwaukee, Wis.
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T. E. Gaffney.
Rock County Concrete Stone Co., Janesville, Wis.
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"Rock Products," 431 Main st., Louisville, Ky.
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Ben F. Lippold.
Inkerman Bailey.
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St. Catherine's Building and Paving Co., Ltd., St. Catherine, Ont., Canada.
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St. Louis Hollow Concrete Block Construction Co., 7600 N. Broadway, St. Louis, Mo.
Geo. Guthrie.
Salina Hydraulic S. & B. Co., Santa Fe Ave. Salina, Kansas.
F. C. Henry.
J. Duncan, Salina Hydraulic Stone & Brick Co., Salina, Kan.
Sandusky Portland Cement Co., Sandusky, Ohio.
S. B. Newberry.
R. R. Fish, Ft. Wayne, Ind.
Glen M. Porter, Chicago.
The Sanitary Chemical Co., 721 W. Washington Ave., Indianapolis, Ind.
G. G. Fry.
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J. G. Johnson.
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Coltrin Mfg. Co., Jackson, Mich.
B. Schatzinger.
B. J. Schatzinger.
E. C. Schmidt, Cincinnati, Ohio.
The Schmidt Construction Co., Peoria, Ill.
J. P. Schmidt.
The Schoeneman Cement Block Co., George, Iowa.
W. R. Dallman.
T. J. Coakley.
D. A. Schoeneman.
Schuelte Cement Construction Co., Manitowoc, Wis.
H. C. Schuelte.
H. E. Murphy.
E. C. R. Scott, 1637 Asylum Ave. Racine, Wis.
E. W. Seamans Co., Grand Rapids, Mich.
C. Marsman.
R. B. Sears, 13 Park Row, New York.
Harry C. Sense, Lafayette, Ind.
T. Shea, 19 Hampden St., Springfield, Mass.
Andrew J. Shea, 19 Hampden St., Springfield, Mass.
Jas. Shearer, Collingwood, Ont.
Sheldon Bros., 617 11th Ave., Maywood, Ill.
Thos. H. Sherman, Terrace Pl. and 20th st., Brooklyn, N. Y.
G. F. Shreve, 308 20th st., Milwaukee, Wis. Mason & Contractor.
Simpson Bros. Corporation, 166 Devonshire st., Boston, Mass.
N. P. Winchell, Asst. Treas.
J. B. Simpson, V.-Pres.
Simpson Cement Mold Co., 351 Marshall ave., Columbus, O.
H. G. Simpson.
Simplex Mfg. Co., 124 Cortland st., Jackson, Mich.
C. Whitney.
A. C. Dornfeld, Kenosha, Wis.
James Sinclair, Marquette, Mich.
O. F. Smith & Son, Broadhead, Wis.
E. A. Smith.
The T. L. Smith Co., 604 Merrill Bldg., Milwaukee, Wis.
E. W. Meyer.
T. L. Smith.
W. J. Buckley.
Jacob Smith, Cleveland, Ohio.
J. A. Sodestrom, Sac City, Iowa.
J. W. Spinka, Chadwick, Ill.
Sponholz Co., 409 Uihlein Bldg., Milwaukee, Wis.
E. A. Sponholz.
Gus Kahn.
South Bend Machinery Mfg. Co., South Bend, Ind.
A. P. Starr.
E. Snell.
H. H. Hutson.
Geo. Graun.
South Side Roofing & Cement Co., 235 Reed st. Milwaukee, Wis.
A. Toppins.
H. R. Hansen.

The Standard Machine Co., Kent, Ohio.
F. A. Kershaw.
A. L. Post.
The Standard Sand & Machine Co., 1507 St. Clair st., Cleveland, Ohio.
A. L. Boughton.
J. W. Boughton.
The Standard Stone Co., 1 Madison ave., New York.
J. C. McClanahan.
W. W. Benson.
L. J. Thompson.
Geo. L. Stanley, Ashtabula, Ohio.
F. A. Stare, Frankfort, Ind.
H. B. Stephens, Contractor, Eaton, Ohio.
Stevens Cast Stone Co. 147th st., Harvey, Chicago, Ill.
C. W. Stevens.
G. W. Tainter, Jr.
Stevens Stone Co., Akron, New York.
Uriah Cummings.
J. W. Stewart, Paris, Ill.
Stocker Gravel & Art Stone Co., Highland, Ill.
Fred Stocker.
H. A. Zobrist.
Ed. Scott, Darlington, Wis.
Stringer Machine Co., Jackson, Mich.
Eber S. Peek.
Stromsberg Concrete Stone Wks., Stromsberg, Neb.
F. C. Halden.
Sullivan Cement Works, Sullivan, Ind.
Alfred H. Mankedick.
Chas. Mankedick.
P. F. Tall, 3172 N. Capitol ave., Indianapolis, Ind.
L. A. Tarr, Edinburg, Ind.
Terre Haute Coal & Lime Co., Terre Haute, Ind.
J. W. Landrum.
Texis Bros., Humboldt and Commerce sts., Milwaukee, Wis.
P. J. Bliffert, Jr.
Thomsen & Smart, 118 Oakley ave., Waukegan, Ill.
R. L. Smart.
Toch Bros., 320 5th ave., New York.
F. H. Upton.
T. W. Saveland.
Toledo Cement & Block Co., Toledo, Ohio.
A. J. Johnson.
Curt. M. Treat, 77 Jackson blvd., Chicago, Ill.
Joseph Trompeter, Peru, Ill.
E. E. P. Truesdell, Belvidere, Ill.
C. A. P. Turner, 816 Phoenix st., Minneapolis, Minn.
Two Miracles Concrete Co., Minneapolis, Minn.
R. O. Miracle.
Joe Ubbink, Port Washington, Wis.
N. Underwood.
Usona Manufacturing Co., Urbana, Ill.
Fred Eiklor.
Victor Concrete Mfg. Co., Janesville, Wis.
John Rogers.
Victor E. Rogers.
Vulcanite Portland Cement Co., Flatiron Bldg., New York City.
Albert Moyer.
Wm. L. Wallace, Roanoke, Ind.
C. Walker & Son., North Platte, Neb.
Ed. Walker.
Walton Granolithic Co., 2500 E. 18th st., Kansas City, Mo.
E. M. Walton.
I. L. Walton.
F. S. Phipps.
Wapakoneta Cement & Block Co., Wapakoneta, O.
H. C. Wentz.
William Runkle.
W. H. Ward & Son, Harvard, Ill.
Charles D. Watson, Roman Stone Co., Toronto, Can.
Merrill Watson, 256 Broadway, New York.
J. O. Watterworth, 512-514 Troy Bldg., Duluth, Minn.
Welch & Hawley, Wibona, Ill.
C. J. Welch.
Mrs. T. R. Welch.
Welch & Minnich, Nicholasville, Ky.
S. R. Minnich.
P. P. Welty, Columbus Grove, Ohio.
West Bend Concrete Works, West Bend, Wis.
The Western Builder, 308 Montgomery Bldg., Milwaukee, Wis.
Ivan C. MacDonald.
D. S. Roberts, Davidson Hotel.
Adolph Adams, Kendallville, Ind.
P. L. Johnston.
B. M. Toutloff.
Western Lime & Cement Co., Milwaukee, Wis.
E. J. Sigwalts, N. W. Lime Co., St. Paul, Minn.
F. C. Bailey.
Wm. C. Lantry.
R. Cook.
M. T. Ash.
A. W. Grider.
Western Portland Cement Co., Yankton, S. D.
G. S. Bartlett, Milwaukee, Wis.
C. B. McKay, Milwaukee, Wis.
Western Whiting & Mfg. Co., Elsah, Ill.
Alex Marshall.
Geo. M. Whitcomb, Desplaines, Ill.
J. E. White, 132 La Salle st., Chicago.
White Cement Machinery Co., Jackson, Mich.
C. O. White.
Robert Campbell.
C. L. Wilber, 717 18th st., Denver, Col.
Emil Court, 594 Prospect st., Herold, Wis.
Williams Mfg. Co., 301 Journal Bldg., Chicago, Ill.
W. O. Williams.
J. E. Wilson, Jr., Logan, Utah.
Winget Concrete Machine Co., 482 N. High st., Columbus, Ohio.
J. F. Angell.
Tom Kraner.
A. Clark.
J. F. Angell.
E. B. McDowell.
D. T. Kraner, 6812 Hamilton ave., Pitsburg, Pa.
S. M. Coe., Indianapolis, Ind.
A. W. Winzenburg & Son, Wood's Blk., Sedalia, Mo.
A. W. Winzenburg.
Wisconsin Brick Co., Madison, Wis.
E. W. Smythe.
Wisconsin Hollow Concrete Wall Co., 314 Broadway, Milwaukee, Wis.
Walter B. Potter.
W. H. Carson.
Alfred Meurer.
Harry Woodhouse, Halcyon Place, Yonkers, N. Y.
Wolverine Portland Cement Co., 902 Chamber of Commerce, Chicago, Ill.
W. E. Cobean.
York Hydraulic Stone Co., York, Neb.
L. E. Porter.
L. A. Young, North Manchester, Ind.
Rudolph Zek, 1321 Fredericka st., Milwaukee, Wis.

Exhibitors at the Milwaukee Convention N. A. C. U.

The following firms had exhibits at the Milwaukee convention of the National Association of Cement Users:

Anchor Concrete Stone Co., Rock Rapids, Iowa.
Atlas P. C. Co., New York, N. Y.

Aut. Build. Blk. Mach. C., Jackson, Mich.
Barker & Nighswander, Toledo, Ohio.
Blanc Stainless Cem. Co., New York, N. Y.
Castalia P. C. Co., Castalia, O.
Cement & Engineering News, Chicago, Ill.
Cement Machinery Mfg. Co., Burlington, Iowa.
Century Cement Mach. Co., Rochester, N. Y.
Chase Fdy. & Mfg. Co., Columbus, Ohio.
Chicago Portland Cem. Co., Chicago, Ill.
Concrete Pub. Co., Detroit, Mich.
Construction News, Chicago, Ill.
Dever Cement Tank & Silo Co., Cassopolis, Mich.
Driscoll & Gochnauer, Appleton, Wis.
S. L. Dunlap, Indianapolis, Ind.
The Durolithic Co., Buffalo, N. Y.
Edison P. C. Co., Philadelphia, Pa.
The T. O. Eichelberger Co., Dayton, Ohio.
Eureka Machine Co., Jackson, Mich.
Fairbanks Morse Co., Milwaukee, Wis.
Hartwick Mach. Co., Jackson, Mich.
Hayden Aut. Blk. Mac. Co., Columbus, O.
The Hoosier Cement Post, Elkhart, Ind.
Ideal Concrete Mach. Co., South Bend, Ind.
Illinois Steel Co., Cement Dept., Chicago, Ill.
Indestructible Post Co., Chicago, Ill.
International Fence & F. P. Co., Columbus, Ohio.
Iowa Bldg. Block Co., Waterloo, Ia.
Jaeger Aut. Mach. Co., Columbus, Ohio.
Knickerbocker Co., Jackson, Mich.
T. M. Lehew & Son, Wausau, Ind.
Lehigh P. C. Co., Allentown, Pa.
Marquette Cement Mfg. Co., Chicago, Ill.
Metropolitan Stone Co., 1 Madison ave., New York.
Milwaukee Concrete & Supply Co., Milwaukee, Wis.
Miracle Pressed Brick Co., Minneapolis, Minn.
Morgan & Burnham, Milwaukee, Wis.
MUNICIPAL ENGINEERING Co., Indianapolis, Ind.
Municipal Eng. & Con. Co., Chicago, Ill.
National Builder, Chicago, Ill.
New-Way Motor Co., Lansing, Mich.
Northwestern Expanded Metal Co., Chicago, Ill.
H. S. Palmer Co., Washington, D. C.
Peerless Brick Mach. Co., Minneapolis, Minn.
Penna. Cement Co., New York, N. Y.
Perfection Block Mach. Co., Minneapolis, Minn.
Pettyjohn Company, Terre Haute, Ind.
Queen City Brick Mach. Co., Traverse City, Mich.
Reading Brick Mach. Co., Reading, Pa.
Ricketson Mineral Paint Wks., Milwaukee, Wis.
St. Louis Expanded Metal Fireproof Co., St. Louis, Mo.
Sandusky Portland Cement Co., Sandusky, Ohio.
Sanitary Chemical Co., Indianapolis, Ind.
Schoeneman Cem. Blk. Co., George, Iowa.
E. W. Seamans, Grand Rapids, Mich.
Simplex Mfg. Co., Jackson, Mich.
T. L. Smith Co., Milwaukee, Wis.
J. A. Sodestrom, Sac City, Iowa.
South Bend Mach. Mfg. Co., South Bend, Ind.
Standard Mach. Co., Kent, O.
Standard Sand & Mach. Co., Cleveland, O.
Standard Stone Co. of America, New York City.
Sterling Wheelbarrow Co., Milwaukee, Wis.
Stevens Cast Stone Co., Harvey, Ill.
E. W. Thompson, Dowagiac, Mich.
Western Builder, Milwaukee, Wis.
Western Portland Cement Co., Milwaukee, Wis.
Williams-Moore Co., Chicago, Ill.
Winget Concrete Mach. Co., Columbus, O.
Wisconsin Hollow Con. Wall Co., Milwaukee, Wis.
Youngstown Expanded Metal Fireproofing Co., Youngstown, Ohio.

Acquittal of John W. Hill.

The jury, acting under binding instructions from Judge Audenried, acquitted John W. Hill former chief of the filtration bureau at Philadelphia, January 12. The court declared that, "in no way had the commonwealth proven its case." The verdict of the jury was greeted with cheers and the people crowded around Mr. Hill and tried to shake hands with him. Mr. Hill's trial lasted nine days. His arrest was one of the sensational features of Mayor Weaver's crusade for good government. The mayor instituted an investigation into the construction of the city filtration plant. A commission of engineering experts was appointed by Mayor Weaver to inspect the filter plant. The commission consisted of Major Cassius E. Gillette, United States engineer corps; W. Barclay Parsons, of New York; John Donald MacLennan, of Washington. No member of this commission was called to testify during the trial. Following the investigation, Mr. Hill, who had in the meantime resigned his position, was arrested on charges of forgery and falsifying the records of his bureau. The commonwealth claimed that a contracting firm had been paid for work that was not performed. One of the principal charges against Mr. Hill was that he accepted a leaky conduit from the contractors and had certified that it was water-tight.

The Ohio Engineering Society.

The twenty-seventh annual convention of the Ohio Engineering Society was held at Columbus, O., January 22, 23 and 24. Some of the addresses were on the following subjects: "The Relation of Geology to Engineering," T. C. Connar, Zanesville; "The Water-Softening Plant at Oberlin; "Natural Cement and Its Present Status in Engineering Construction," J. A. Fairleigh, Louisville, Ky.; "Organization of Bridge Companies, Development and Present Trend," Prof. W. H. Broughton, Morganstown, W. Va.

The attendance was excellent, eighty members being present and nearly 200 non-members registering during the meeting. Thirty-seven new members were elected.

The following officers were elected for the coming year. President, G. A. McKay, city engineer and county surveyor, Xenia, O.; vice-president, John Laylin, city engineer and county surveyor, Nor-

walk, O.; secretary-treasurer, E. G. Bradbury, 85 N. High st., Columbus, O. Trustees: A. F. Cole, county surveyor and city engineer, Marietta, O.; W. C. Wangler, engineer Milton Coal Co., Wellston, O.; Prof. J. L. Gilpatrick, Denison University, Granville, O.; Chas. A. Judson, collector of customs, Sandusky, O.; J. R. Marker, county surveyor, Greenville, O.

The special comittee on legislation presented a bill providing for the establishment of a State board of registration and examination for civil engineers and surveyors, which was adopted after long discussion with slight change.

Bills providing for further investigation of sewage disposal and water purification plants by the State Board of Health, and for legalizing the use of oil for street and road sprinkling, were indorsed, as was also a salary law for county surveyors.

A section of county surveyors was organized, with the following officers: President, J. L. Gilpatrick, Granville; vice-president, J. W. Turner, Jackson; secretary-treasurer, John Laylin, Norwalk.

A municipal section was organized, with the following officers: President, R. E. Kline, Dayton; vice-president, Paul R. Murray, New Philadelphia; secretary-treasurer, E. G. Bradbury, Columbus.

Technical Meetings.

At a meeting of the Engineers' Club, at Columbus, O., January 20, a committee was appointed to confer with a committee from the Engineers' Club of Cleveland to discuss ways and means of preventing the pollution of streams of Ohio. The question was brought before the club by Julian Griggs, city engineer, reading a letter from the Cleveland club, in which was given some details of the work so far done in the matter by that club. The state and the local Board of Health are trying to solve the same question. The committee consists of C. E. Sherman, of the State University; Winthrop Pratt, engineer with the State Board of Health; Julian Griggs, city engineer; Harry Holton, assistant city engineer, alternate. W. A. Knight, of the manual training department of Ohio State University, discussed the question of "Modern Grinding as Applied to Machine Work."

At the annual meeting of the Western Society of Engineers, held in Chicago January 2, officers were elected as follows: President, B. J. Arnold; vice-presidents, W. L. Abbott, Andrews Allen, Dugald Jackson; treasurer, A. Reichmann; secretary, J. H. Warder. A dinner followed the meeting, at which the first address was made by the retiring president, E. C. Carter, while the new president, B. J. Arnold, gave an address describing the new terminals and electric traction system of the railways entering New York city, illustrated by stereopticon views. Other addresses were: "Ownership of Public Utilities," L. E. Cooley; "The Engineer and the Law," Isham Randolph; "The Contracting Engineer," Onward Bates; "The Development of University-Trained Engineers," Prof. D. C. Jackson; "Electrical Communication, S. G. Mean.

At the annual meeting of the Engineers' Society of Western Pennsylvania, held at Pittsburg January 4, officers were elected as follows: President, Julian Kennedy; vice-president, J. K. Lyons; secretary, F. V. McMullin; treasurer, A. E. Frost; directors, A. R. Raymer, E. K. Morse.

At the annual meeting of the Pacific Northwest Society of Engineers, held at Seattle, Wash., January 6, officers were elected as follows: President, James D. Blackwell; vice-presidents, A. H. Fuller, J. J. Cryderman, J. C. Jeffrey; secretary, A. H. Dimock; treasurer, H. W. Scott; librarian, A. B. Coe; directors, Minor Roberts, J. M. Clapp, H. Day Hanford, C. H. Rollins, T. A. Noble, Theodore F. Rixon, Marvin Chase, C. H. Topp.

The annual dinner of the Municipal Engineers of New York city was held at the St. Denis Hotel on the evening of January 10. Samuel C. Thompson, president of the society, acted as toastmaster, and among the after-dinner speakers were Charles Whiting Baker, D. L. Hough, Geo. S. Rice, John J. McLaughlin, Past President Nelson P. Lewis and Geo. W. Tillson, nominee for president for the ensuing year.

The annual meeting of the National Fire Protection Association will be held in Chicago May 22 to 24.

The organization of the Illuminating Engineering Society was completed January 10 at the Hotel Astor, New York city. The object of the society, according to the constitution adopted, is to bring about co-operation between the illuminating engineer, the gas engineer, the architect and the fixture manufacturer, for the improvement of illumination. Regular meetings will be held each month at the Hotel Astor, New York city, and also at Chicago, Denver and San Francisco, as soon as these branch societies can be organized. The annual meeting will be held in New York city in January of each year, when papers will be presented and published as society transactions. Officers for the ensuing year were elected as follows: President, L. B. Marks, illuminating engineer; vice-presidents, Dr. G. H. Sharp of the New York testing laboratories, A. A. Pope

of the New York Edison Co.; secretary, E. L. Elliott, chief engineer of the Consolidated Gas Co., New York city; treasurer, W. R. Lansingh.

At the annual meeting of the Canadian Society of Civil Engineers, to be held at Toronto January 30, 31 and February 1, papers will be presented as follows: "Tide Levels and Datum Planes on the Pacific Coast of Canada," W. Bell Dawson; "The Hydraulic Locks on the Trent Canal," W. J. Francis; "Laying a Six-Foot Steel Pipe for the Toronto Water Works," C. L. Fellowes; "The Septic-Tank Process," W. R. Butler.

The Iowa Engineering Society held an interesting meeting at Des Moines January 10 and 11.

The Civil Engineers' Society of St. Paul, Minn., has elected officers for the ensuing years as follows: President, Oscar Clausen; vice-president, Maj. J. D. Du Shane; secretary, C. L. Annan; librarian, C. A. Winslow; treasurer, J. H. Wolf.

The American Ceramic Society will hold its eighth annual meeting in Philadelphia February 5, 6 and 7. Those desiring information concerning the society, its membership and the forthcoming convention can obtain same by application to Prof. Edward Orton, Jr., Ohio State University, Columbus, O.

The twentieth annual convention of the National Brick Manufacturers' Association will be held at Philadelphia February 5 to 17.

Personal Notes.

John N. Heeney has been reappointed city engineer, at Cohoes, N. Y.

Frank E. Link has been elected clerk of council, at Canal Dover, O.

W. H. Boeh was re-elected superintendent of water works at Cincinnati, O.

E. R. Cary has been appointed city engineer, at Troy, N. Y.

Colin R. Wise has been re-elected county engineer of Passaic county, N. J.

Lester H. Robinson has been appointed city engineer, at Middletown, N. Y.

J. W. Shone, of the Century Cement Machine Co., of Rochester, N. Y., died recently.

John Dougherty, president of the New York Continental Jewell Filtration Co., died in New York City recently.

Major H. R. W. Hartwig, ex-mayor of St. Joseph, Mo., died in that city recently, aged 68 years.

George C. Warren was re-elected president of the water commission at Saginaw, Mich.

P. K. Lewis has been appointed city engineer and W. E. Sutton street commissioner, at Everett, Wash.

J. Walter Ackerman, Assoc. M. Am. Soc. C. E., has been reappointed city engineer of Auburn, N. Y., which position he has held for the last four years.

Hon. Charles Holman, ex-mayor of Nashua, N. H., died January 14, aged 72 years.

Hon. J. Leighton, former mayor of Camden, N. J., died January 12, of appendicitis, aged 50 years.

George M. Wulgrove, 42 East 23rd st., New York City, has been appointed park commissioner for the Bronx.

R. M. Smith has been appointed superintendent of the water department, at White Plains, N. Y.

Charles E. Knowlton, of Quincy, Mass., has been appointed city engineer, at Marlboro, Mass.

Herbert B. Blair topographer in the United States geological survey, died at his home in Washington, D. C., recently.

Wallace Greenalch has been reappointed superintendent of waterworks, at Albany, N. Y.

David Hammond, for many years at the head of the Canton Bridge Co., died in Canton, O., recently.

Hershel Brownlee has been appointed superintendent of the waterworks and electric light plants, at Port Gibson, Miss.

Hugh J. Gallagher, U. S. A., purchasing agent of the Isthmian Canal Commission, has been transferred to Manila, P. I.

H. P. Cumings and F. N. Downer have formed a partnership and will practice civil engineering at Painesville, O., under the firm name of Cumings & Downer.

James P. Morrissey, city engineer of Dunkirk, N. Y., has been appointed county engineer and surveyor for the county of Chautauqua, N. Y.

H. Dayton Humphrey has been elected chairman of the water board, at Hartford, Conn., to succeed the late Thomas S. Hall.

Chris Eberling has been appointed engineer of the city waterworks and chief engineer of all the city plants, at Hamilton, O.

K. & R. Tanner, civil engineers, has changed its name to Tanner Bros., and will occupy new offices at 608 Manhattan Bldg., St. Paul, Minn.

Ovid B. Winslow was re-elected superintendent of streets, and A. C. Blain assistant superintendent of streets, January 2, at Nashua, N. H.

John Hickey, ex-mayor of Chenoa, Ill., died sudenly of heart failure, January 9, at Hot Springs, where he had gone for the benefit of his health. Mr. Hickey was nearly 69 years old.

William S. Schreiber, town clerk, of Bridgeport, Conn., was found dead in a room filled with gas at the Union Hotel, January 21. He had been missing since Wednesday night.

Robert B. Campbell, who has been connected with the Ransome Concrete Machinery Company, of New York City, has opened a New England office for that firm at 6 Beacon street, Boston, Mass.

Anton L. Petterson has been appointed city surveyor, at Passaic, N. J., to fill the unexpired term of Colin R. Wise, who was appointed county engineer of Passaic county.

W. G. Turner, hydrographic engineer in the United States geological survey, has been detailed to assist State Engineer Wade in making topographical surveys in Montana.

Clifford A. Tinker has resigned as assistant to the town engineer of Westfield, Mass., and has established an office for the practice of civil engineering in the Postoffice building, at Westfield.

George F. Madock, M. Am. Soc. C. E., has severed his connection with A. L. Ide & Sons, Springfield, Ill., as general superintendent, and will open an office for general engineering at 824 Marquette Bldg., Chicago.

John Mowat, formerly chief government inspector on the Anacostia bridge, at Washington, D. C., has resigned and

accepted a position as superintendent of construction for the Pennsylvania Steel Company.

Edward Duryee, who has been superintending for the United States government the erection of the large cement mill at the Roosevelt dam in Arizona, has received a permanent appointment in the United States reclamation service.

A. N. Johnson has resigned as highway engineer of the office of public roads, United States Department of Agriculture, and has been appointed state highway engineer of Illinois by the highway commission, with headquarters at Springfield, Ill.

Col. Eugene E. McLean, who has been chief engineer in the comptroller's office in New York City for the last twenty-five years, died January 5. In his work as a civil engineer, Col. McLean had charge of the laying out of Central Park.

George T. Hammond has been appointed division engineer of the Baltimore sewerage commission, in charge of storm-water sewers. Mr. Hammond has been connected with the department of sewers in Brooklyn for a number of years.

G. R. Patton, city chemist and bacteriologist, of Lorain, O., has accepted the position of superintendent and bacteriologist of the filter plant at Youngstown, O., and will enter upon his duties February 16.

P. H. McEvey was re-elected superintendent of streets at Youngstown, O. F. M. Lillie was retained as city engineer, with Harry M. Reel, Singleton King and E. H. Turner, Jr., as first, second and third assistants, respectively.

Walter H. Sears, M. Am. Soc. C. E., has been appointed chief engineer of the aqueduct commission of New York City. J. Waldo Smith, M. Am. Soc. C. E., has been appointed chief engineer of the new board of water supply.

The new sewerage commission of Baltimore, Md., has made appointments, as follows: Frank T. Daniels, drafting engineer, $2,100 per year; Herbert W. Knight, central office engineer, $2,100; C. A. Emerson, Jr., chemist and bacteriologist, $780.

Wm. J. Lewis, formerly of the Oliver Iron & Steel Company, which was originally the Lewis, Oliver & Philips Co., died at Pittsburg, Pa., January 3. Mr. Lewis invented the first machinery for making nuts and bolts, and was credited with numerous inventions in iron and steel.

Charles W. Whittle has been appointed engineer in charge of the department for gathering and tabulating information regarding underground pipes, mains, etc., of the city engineer's department, at Baltimore, Md., succeeding August E. Christhilf, who becomes chief engineer of the commission for opening streets.

W. H. Harding has resigned the presidency of the Bonneville Portland Cement Company to become general manager of the Coplay Cement Manufacturing Company. Mr. Harding will have offices in the Pennsylvania Bldg., Philadelphia. Joseph P. Mack succeeds Mr. Harding as president of the Bonneville company.

Messrs. Oscar Claussen, Edw. P. Burch and Charles L. Pillsbury entered into a partnership, January 1, 1906, under the name of Claussen, Burch & Pillsbury, and will practice as consulting engineers on hydraulic, steam and electrical engineering, with offices in the German-American Bank Bldg., St. Paul, Minn., and the Guaranty Bldg., Minneapolis, Minn.

William B. Ellison has been appointed commissioner of water supply, gas and electricity, at New York City, for the ensuing four years, by Mayor McClellan. Other appointments made by Mayor McClellan are: Commissioner of bridges, James W. Stevenson; dock commissioner, John A. Bensel; police commissioner, Brigadier General Theodore A. Bingham, U. S. A.

Dr. Gilbert J. Fowler, consulting chemist to the rivers department of Manchester, England, and for some years superintendent and chemist of the Manchester Sewake Works, has gone to Calcutta, India, where he has been engaged by the government of Bengal on sewage disposal questions, primarily in regard to the jute mills on the Hooghly river, the westernmost channel of the Ganges, at its delta.

John W. Leib, Jr., has been appointed by the directors of the American Institute of Electrical Engineers a trustee of the new Union Engineering Society, which is in charge of the new Union Engineering building. Mr. Leib was also made a member of the building committee, representing the institute, succeeding Dr. S. S. Wheeler, who, since his recent election to the presidency of the institute, has resigned from the other bodies.

Dr. Otto A. Moses, geologist and chemist, died in New York City January 3. Dr. Moses started business as a mechanical and electrical engineer, and was largely instrumental in the introduction of the Edison inventions in Europe. He later became state geologist of South California, and for several years had general supervision of the phosphate works. He was founder of the Hebrew Technical Institute in New York City, for free scientific education of poor Hebrew boys.

Robert L. Lund, Assoc. M. Am. Soc. C. E., Little Rock, Ark., has accepted a position as consulting engineer for the Roberts, Johnson & Rand Shoe Store, of St. Louis, and will remove to that city. Mr. Lund is succeeded in his engineering practice at Little Rock by his brother, Alfred M. Lund, and Philip B. Hill, under the firm name of Lund & Hill, at 211 W. Second st. Mr. Hill was recently field engineer for the Tennessee Copper Co., at Copper Hill, Tenn., on the construction of their smelter plant.

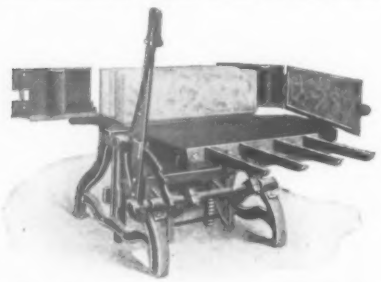
Mr. A. Eugene Michel is now with the Geo. H. Gibson Co., advertising engineers, Park Row Bldg., New York City, having resigned as assistant advertising manager of the Standard Paint Co. Mr. Michel is a graduate of Rose Polytechnic Institute, and his professional experience includes two years in the engineering department of the Diamond Chain Works of the Federal Manufacturing Co, charge of the testing department of the Ewart Manufacturing Co., and assistant managership of the department of publicity of the International Steam Pump Co., under Mr. Gibson.

The Pennsylvania Steel Company, Girard Bldg., Philadelphia, has elected new officers, as follows: H. H. Campbell has been appointed to the office of metallurgical engineer, and will occupy a similar position with the Maryland Steel Company and the Spanish-American Iron Company; J. V. W. Reynders has been elected vice-president, and will have full charge of all the company's affairs at Steelton; John W. Dougherty has been appointed general superintendent of the Steelton works; F. D. Carney has been appointed assistant general superintendent of the Steelton works; Thomas Earle has been appointed superintendent of the bridge and construction department.

MACHINERY AND TRADE

Cement-Block and Brick Machinery.

The Cement Machinery Co., Jackson, Mich., now has quite a full line of concrete-block machines for all uses, which are illustrated in the accompanying pictures. The first shows the standard Normandin machine, the second the Peninsular, which makes blocks with the face down; the third is the Champion, a low-priced machine, which makes a face-down



THE NORMANDIN BLOCK MACHINE.
Cement Machinery Co., Jackson, Mich.

block when tamped and a face-up block when pressed; the fourth is the Cemaco, a side-face machine of medium price. The company also has a brick machine, and the last cut shows the Favorite No. 1. Post machines, concrete mixers, conveyors and other machinery needed in a block plant are also in their list.

This company reports that the difficulty about the place of meeting of the National Association of Cement Users, which arose just before the convention, prevented its shipment of machines on account of the uncertainty as to he place of shipment until too late to get them to Milwaukee, except by express, at an expense which they did not wish to incur. The company had several representatives on the ground and reports good business, notwithstanding it did not have its large exhibit in place.

Grab Buckets for Digging.

The Browning Engineering Co., of Cleveland, O., has recently issued two bulletins of interest to those handling sand, gravel and other contractors' materials, as well as fuel, cinders and refuse of various sorts.

The Browning square type of automatic grab bucket has two ropes, one hoisting and closing the bucket and the other suspending and opening it. It will dig ashes, coke, coal, cinders, city refuse, crushed stone, ballast, grain, gravel, mud, ore, sand, salt, slag, sawdust or materials similar. It has very few parts and is simple in operation. One plant for loading sand on cars is illustrated, in which the average cost was 2 cents a ton, including loading, switching, operating expenses, etc.

American Asphalt Developments.

The production in our country of manufactured goods of innumerable kinds, previously made in other nations, long ago became so common as to cease to be of public interest. Less common and more noteworthy has been the production of raw materials which it was supposed did not exist in our land and could not be produced here. One of these is asphalt.

When Edward De Smedt discovered, in 1869, that a small proportion of asphalt mixed with common sand would produce the most admirable pavements ever known its was supposed that the island of Trin-

THE PENINSULAR BLOCK MACHINE.
Cement Machinery Co., Jackson, Mich.

idad was the only source from which the cementing material could be obtained.

Later important asphalt deposits were found in Venezuela, but almost a quarter of a century passed after De Smedt laid his first asphalt pavement before the Alcatraz mine was found in Santa Barbara county, California.

Beginning in 1894, considerable of this

material was shipped to New York and other important cities. In 1896 contractors using this material began to receive from California a purer, cleaner asphalt than previously. They were pleased with this purer asphalt, but it was not generally known that it was obtained from refining the asphaltic oils of California.

During the last eight years the production of this California asphalt has enormously increased, and it is now known that instead of being dependent upon President Castro and the owners of Trinidad lake for our supply of this material we can ourselves supply the needs of the whole world.

The most important asphalt and paving companies have strongly opposed the introduction and use of our American asphalt. Its use has revolutionized the paving industry, created brisk competition and lowered paving prices. The opposing interests have striven to induce municipal authorities to adopt paving

THE CHAMPION BLOCK MACHINE
Cement Machinery Co., Jackson, Mich.

specifications adverse to California asphalt, and have, as a feeble effort to create prejudice against it, called it "residual pitch." Notwithstanding all opposition, it is steadily winning its way. Its use is increasing in every section of the country. It has driven out all competitors in Pacific coast cities, is forging ahead in the middle West and is being used in immense quantities in New York and other cities. Over 450 streets and sections of streets in New York city alone are paved with it.

The paving companies using it in New York have found, after eight years of experience with it, that they are relieved from expense for repairs during the maintenance period. Owing to this, they took many contracts in 1905 at from 74 to 80 cents per yard. Of twenty-two streets laid with this material in Brooklyn in 1897 the records of the Highway Department show smaller average cost per yard for repairs than the streets paved with any competing material.

It is interesting to find asphalt companies beginning to use our native material who have fought desperately in courts and

THE CEMACO BLOCK MACHINE.
Cement Machinery Co., Jackson, Mich.

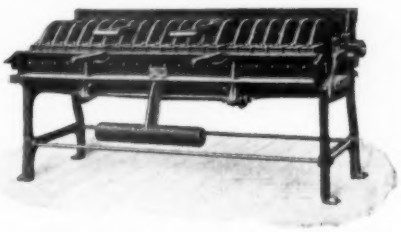
with armed men in tropical swamps for possession of Venezuelan deposits.

About 44,000 tons of refined California asphalt were sold in 1905, and a great increase seems certain in 1906.

Pneumatic Tools for Concrete Workers.

The Chicago Pneumatic Tool Co. states that on account of the compressor business being offered exceeding its manufacturing capacity (amounting to only 400 compressors during the year 1905) arrangements are now under way for increasing the capacity of its compressor works at Franklin, Pa., so as to give it an annual output of between 650 and 700 compressors.

The machines of its manufacture are gradually taking the lead, thus necessi-



THE FAVORITE NO. 1 BLOCK MACHINE.
Cement Machinery Co., Jackson, Mich.

tating increased facilities for taking care of the business offered.

A large volume of business was lost to the company during 1905 on account of inability to make deliveries.

The company made a prominent exhibit in connection with the Milwaukee convention of the National Association of Cement Users, in the plant of the National Building Block Machine Co., which is equipped with pneumatic tampers for making concrete blocks. Greater density of blocks is an important claim, as well as rapidity of operation. Tools for chipping or working the surfaces of artificial stone are also used as pneumatic tools. Special circular No. 55 will be sent on aplication to the Chicago Pneumatic Tool Co., Fisher Building, Chicago.

Wagons for Municipal Work.

Two wagons are manufactured by the J. E. Briggs Labor Saving Specialty Company, of Waterloo, Iowa, which are notable improvements in municipal equipment for hauling night soil, garbage, street cleaning refuse, ashes, etc. The illustration shows one with a cylindrical box designed for the purpose of hauling night soil. It is constructed entirely of steel and weighs about 1,600 pounds. The drum, or box, has an opening in the top, which is closed by a close-fitting lid, and the load is discharged from an opening at the bottom of the rear end. This opening is so closed that it is practically water-tight. It is strongly built, makes a very neat appearance on the street and is sanitary. The merit of this contrivance for this class of work can be readily appreciated by all municipal governments.

The other wagon is used for street sweepings and garbage of all kinds. It is a rear-end dumping wagon, with a light, detachable, but substantial, top to keep papers and other loose garbage from blowing off the load. It is constructed, with the exception of the wheels and tongue, entirely of steel. The load dumps instantly by foot pedal and the box is returned to position easily by the driver on the seat or by a man standing at the side of the wagon. It locks itself automatically until the next load is dumped. The wagon is perfectly simple in every feature and can be operated by a boy large enough to drive. The box tilts to an angle of 45 degrees and, being 4 inches wider at the rear than at the front end, any material, sticky or otherwise, will be discharged back of the rear wheels by gravity. It is said to have the shortest gear of any dump wagon of the same capacity, giving the lightest draft and turning in the smallest space. In fact, team and wagon can be turned on a 12-foot circle. One great advantage that this wagon has for municipal work is that the load may be discharged off an embankment or dock, if desired, with all the wheels remaining on the level.

BRIGGS' SANITARY NIGHT SOIL WAGON.

This particular wagon that the cut illustrates has a capacity of 180 gallons, and was bought by the Isthmian Canal Commission to be used by them in the city of Colon, Panama. These wagons are made with any capacity from 180 gallons to 500 gallons.

Molds for Ornamental Concrete Forms.

The display of the Simpson cement molds, which was located in the Hayden Automatic Block Machine Co.'s exhibit at the National Association of Cement Users, was a center of atraction, as it was the only special display of artistic forms for porch columns, balusters and

rails, stairways, chimneys, etc. The reported sale of a large number of the molds is evidence that they are wanted by many block makers. , The Simpson Cement Mold Co., Columbus, O., makes the molds and issues a small catalogue showing its forms and prices and photographs of the prod-

THE COCHRAN CEMENT BRICK MACHINE.

uct. The molds carried in stock at present include rock-faced and plain-faced blocks for columns and chimneys, 4 and 8 inches high and 8, 12 and 16 inches square, ogee cap and base molds and circular or band molds of various sizes, molds for round columns, fluted or plain, adjustable molds for porch rails and sills, ornamented and plain, and round ornamental baluster molds. Special attention is called to the quality of the work turned out and to the method of supporting such special forms as the balusters during the process of curing so as to have a perfect result.

Each mold is independent in itself and can be handled by one man. If the business requires it, as many men can be kept at work as there are molds, each turning out his particular form at the best advantage so far as both quality and quantity are concerned. The Simpson Cement Mold Co., Columbus, O., will give further information on request.

The Cochran Double-Mold Cement-Brick Machine.

The Cochran double-mold cement-brick machine is built with a double-mold box, one on either side of the machine. The machine is made in two sizes—No. 1, which molds sixteen brick at a time, eight on each side of the machine, and No. 2, which molds twenty brick at a time, ten on each side. It is claimed that this is tne only cement-brick machine made on which one man can make and carry away twenty brick at each operation.

The pallets of this machine are 30 inches long, hold ten brick each and are made of cast iron. One hundred of them are furnished with each machine.

The machines are all made of cast iron and steel, and all parts are fitted in a mechanical and workmanlike manner. There is nothing to clog, break or get out of order, and every machine is guaranteed to do all claimed for it.

The Cochran machine is manufactured and sold only by the Concrete Engineering and Equipment Co., of Butler, Pa., and Greensboro, N. C.

The Peerless Brick Machine Co.

The Peerless Brick Machine Co. has recently been organized in Minneapolis, and takes over the business of Oliver Nolan, who has for some time been manufacturing cement brick and block machinery. The specialty of the company is the Peerless brick machine, and it has already acquired a reputation which makes it a comparatively easy seller. The company is composed of L. V. Thayer, president; H. E. Storms, vice-president, and L. E. Storms, secretary and treasurer. They have opened temporary offices at 100 Lumber Exchange. They are now engaged in getting out a comprehensive catalogue, and in their introduction say: "We have entered the concrete age. The growing scarcity of lumber, abundance and the low cost of cement are making the use of concrete more and more attractive to buyers and dealers in building material. It is useless to oppose the conditions which

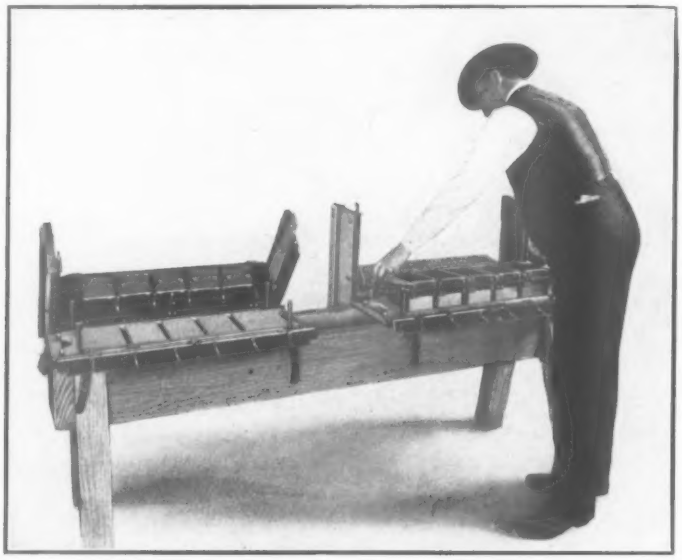
THE PEERLESS BRICK MACHINE.

necessity is forcing upon us. The practical man will lead the advance and get in line as near the front as possible. The Peerless cement-brick machine will give you a place in the front rank."

A few of the qualifications claimed by the company for their machine are that

one man can operate the machine, and that any man can do it. The brick it makes are uniform in size and perfect in every way, having clean, sharp edges and hard, smooth faces. They are tamped on a steel plate, face down, and can be faced with any color, using true concrete for the body. The Peerless delivers the brick face up, and it makes fine-faced brick as well as common brick. They claim that one man can make more cement brick per day with this machine than with any other in the market making the same quality. It is fully warranted as to material, workmanship, infringements and satisfactory operation.

The Peerless cement-brick machine is not an experiment. It is the practical result of twenty-seven years experience in cement work. It is being successfully used in the construction of both public and private buildings in Minneapolis and other cities. It is very simple in construction, easy to operate and, being built entirely of iron, plow steel and boiler plate, will last a lifetime.



THE JOHNSON DOUBLE BRICK MACHINE.

The Johnson Double Brick Machine.

The accompanying photograph shows the operation of the Johnson double brick machine, which was described in MUNICIPAL ENGINEERING for September, 1905. The two machines are set on the same frame and the operator uses them alternately, thus keeping both himself and the two machines busy all the time, the off-bearer removing the brick from one machine while the operator is filling the other. The cut shows the machine on the left open with the pallet inserted for a set of brick as it is left by the off-bearer. Meanwhile the operator has closed the other machine, tamped it full and is removing the set of molds, which he will transfer to the open machine and then proceed to close that machine, fill and tamp, and so on. The hoppers which guide the material to the molds and hold the excess until the next operation are tipped down behind the machines, so that they are not clearly seen.

Unlocking the molds moves the sides apart, so that the set of molds can be removed easily and quickly without danger of disturbing the green bricks.

It is said that one man and a boy can make from 3,000 to 6,000 bricks a day on the double machine, according to their experience and dexterity. Two expert men, one acting as operator and one as off-bearer, have made 9,000 bricks in a day. One man can mix the material required for the two machines.

The National Machinery and Concrete Works, 2[illegible] West South street, Indianapolis, Ind., will respond to requests for further information about the Johnson double brick machine. The large number of brick machines on exhibition at the Milwaukee convention of the N. A. C. U. give evidence of the demand for them, and the Johnson machine should certainly be investigated before purchase is made.

The Monarch Cement Post and Fastener.

The Monarch Cement Post Co., H. S. Quick & Co. general agents, 627 Lemcke building, Indianapolis, Ind., has a machine for making cement posts which operates on the excellent principle of leaving the freshly made post on the inch-board pallet and removing the mold. The mold is adjustable to any ordinary size and length of post and has end plates of various sizes to insert when the sides are adjusted to the size required. When the post is made two men lift the machine or form by means of handles on the main outside frame. By an ingenious automatic arrangement the first motion of the mold plates, when the lift on the handles begins, is to move the plates away from the post, thus leaving the machine free to move without danger of disturbing the green concrete. The machine is then set on another pallet, ready to make another post.

The post is reinforced with a bar of steel 1¼ inch wide and ¼ inch thick, with openings which are filled with concrete during the process of tamping, thus thoroughly bonding the steel and the concrete.

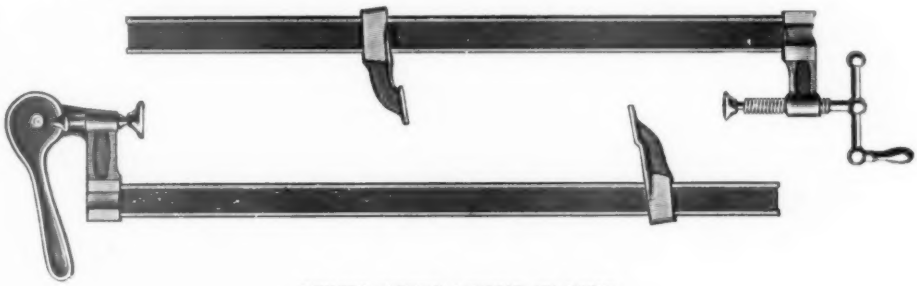
The method of fastening the fence wires to the post is one of the notable features of the Monarch post. Tubes with shoulders on the inner ends are inserted in the post during the tamping process, the inner end being covered with a cap and the outer end being flush with the face of the post. V-shaped steel staples with ends turned over are first slipped over the fence wires, then slipped into the tubes. The bent ends slip over the shoulder at the inner end of the tube and hold the fence wires close to the post. When it is necessary to remove one of the fasteners it can be done by using a pair of pliers to press the two sides of the V together until the bent ends will slip over the shoulder on the tube. If the fastening wires break they can be replaced at almost no expense. The tubes will last indefinitely, as they are subject to a minimum of deterioration. H. S. Quick & Co. will supply any additional information desired.

Cement Workers' Tools.

John Stortz & Son, Philadelphia, Pa., issue a catalogue of cement workers' tools which seems to cover the entire field. The sidewalk, curb and gutter, step, driveway, wall and paving contractors will find their needs, in particular, are fully met. The firm also makes asphalt paving tools.

Clamps for Special Artificial Stone Molds.

The Colt's Quick-Acting Clamps shown in the illustration are most convenient for the use of the concrete man in making sills, lintels, water table or any work requiring special molds. These clamps are quickly adjusted and are made with eccentric and screwheads, and with the I or U bars. The stock sizes are from 6 inches to 96 inches. Special lengths are made to order.



COLT'S QUICK ACTING CLAMPS.

The Eastern Concrete Machine Co., of Akron, N. Y., reports a large sale among concrete men.

Molds for Ornamental Concrete Work.

Many methods have been devised for producing ornamental concrete stone. When made of the proper materials and thoroughly crystalized, artificial stone may be cut to any ornamental design by a stone carver or sculptor. On account of concrete being easily molded into any form desired, this is the method generally employed for making ornamental work from it. The Germans have to considerable extent used both methods, and in forty years' time which they have devoted to the art have achieved a marked success. At the Chicago World's Fair the German government built its exhibits,

and even the statuary, entirely of Portland cement stone, and these exhibits illustrated both ways of making ornamental stone from concrete.

In the past several methods for molding ornamental stone have been attempted in our country. The first of them may be described as the gelatine or glue mold rpocess, by which the sculptors' work, of whatever detail, even tne masterpieces of the ancients, are reproduced in plaster of paris. While this process works admirably with plaster, on account of the slow chemical action or setting of the cement, it has so far been found worthless for making ornamental stone. The slow-setting cement will disintegrate the molds before one cast can be made.

Another method of casting stone is to use patterns, and after molding them in the sand, the same as iron molders would in forming cast iron into desired shapes, pour concrete, which must be in a very wet state—in fact, at least 65 per cent. of water is necessary—into the molds. This process is a very good one where the maker of concrete stone is sufficiently familiar with it and has the practical hand of one who has learned the molders' trade. Even "cut-under" work may be made by this process by using cores or fillers, but the difficulty in making stone by this process will be a drawback to its ever becoming generally used.

Another method by wihch the desired effect may be secured, which was adopted by the builders of the power house of the Chicago drainage canal, is to use plaster of paris molds, and after the concrete is sufficiently hardened, break or cut away the plaster. Of course, this requires special molds to be cast for making each stone.

The average builder does not wish to invest the amount of money necessary to secure this class of work. Therefore some method for molding concrete into ornamental stone must be adopted that will meet with his requirements.

Concrete stone is made in flexible molds of rubber, the flexible molds being held in position until the concrete is sufficiently hard to admit of removing, by a perfectly fitting metal casing. This is a practical method for producing "cut-under" work, and such molds will last for several years in constant use. They are quite expensive, but when the number of stone that may be produced in them is taken into consideration the cost is not so great as to prevent their becoming generally used. Very fine effects may be produced by having an artistic modeler approach as nearly as possible the popular architectural designs that are in general use without adopting details that are cut-under. Metal patterns are made from these designs, and from them the molds are made of cast iron that are thoroughly sand-blasted, thus removing all the rough scale and sand, leaving them as smooth as stove plates. This process is simple—in fact, is the popular one already in use by makers of building blocks. Except for the cost of the original patterns, such molds are inexpensive. After a little practice with them one operator can get as good results as another.

The missionary work necessary for the adoption of concrete as the universal building material has already been pretty thoroughly done. When the conservative companies and builders, as railroad companies, large packing houses, etc., adopt concrete as their material for constructing buildings it is time for the general public to have confidence in the material. There remains no question as to concrete being the most durable of any of the building materials. The building public will now look to the makers of concrete stone machinery to get out such designs as will make the general appearance of the buildings throughout the country more ebautiful than has been produced by brick or lumber so largely used in the past.

When this has been accomplished the much-talked-of "concrete age" will be a reality. The Cement-Working Machinery Co., Detroit, Mich., has supplied the information for this article.

Tests of Cement Brick.

The following is the report of tests of cement brick made by B. J. Lambert, University of Iowa, for the Keokuk Cement Brick Co.:

	Color.	*Previous. Condition.*	*Exact Size.*	*Mod. of Rupture.*	*Unit Crushing.*	*Total Crushing Per Brick. Edge.*	*Side.*
No. 1....	Red.	Frozen, etc.	2 7-16x4	285	1360	28050	43200
No. 2....	Red.	Frozen, etc.	2 7-16x4	273	....	.....	.....
No. 3....	Gray.	Frozen, etc.	2 15-32x4	308	1110	22530	36100
No. 4....	Gray.	Frozen, etc.	2 1-2 x4	478	1480	30050	48100

Bricks had lain out in the rains, frost, etc., and were thoroughly wet and frozen. Brought in in this condition Friday, Dec. 29, 1905, and lay in a room at a temperature of 60 to 70 until Wednesday, January 3, 1906, when tested.

Trade Publications.

The Vulcanite Portland Cement Co., Philadelphia and New York, has printed for general distribution Moyer's paper on "Hair Cracks, Crazing or Map Cracks on Cement Concrete Surfaces."

Studebaker's almanac for 1906 is received. Studebaker Brothers Manufacturing Co., South Bend, Ind.

The Whitehall Portland Cement Co. issues "Cementology," a very small booklet, for monthly distribution.

Collapsible centerings for concrete conduits are described in an illustrated booklet issued by the Collapsible Centering Construction Co., 27 East Alexandrine avenue, Detroit, Mich.

The Doble tangential water wheels are handsomely illustrated and described in Bulletin No. 7 of the Abner Doble Co., San Francisco, Cal.

The Cement-Working Machinery Co., Detroit, Mich., issues a booklet showing baluster posts, balls and other fancy newel tops and bases and columns made in their molds.

Mr. S. B. Newberry's paper on "Concrete Building Blocks" before the National Association of Cement Users has been printed by the Association of American Portland Cement Manufacturers and can be obtained on application to the secretary, 1232 Land Title building, Philadelphia, Pa.

Trade Notes.

ASPHALT.

Coalgate, I. T.—The Stringtown Asphalt Co. has been incorporated, with officers as follows: President, S. W. W. Pomerey; vice-president, W. J. Williams; secretary, Frank urgess.

New York City.—Special.—D. A. de Lima & Co., 17 State st., desires the names of firms manufacturing asphalt paving machinery. They also desire to secure a catalogue of this machinery to send to a client in Venezuela.

Des Moines, Ia.—W. R. McLaughlin, of Sioux City, former state superintendent of the Barber Asphalt Paving Company's construction department in Iowa; Walter Grayson, local superintendent of construction up to January 1, and other employes of the Barber Asphalt Company, together with a number of other men of this city, have formed a new company to engage in the asphalt paving business. The company will be ready to begin business by February 1.

Jersey City, N. J.—The Asphalt Grille Paving Co., 15 Exchange Place, has been incorporated to manufacture and lay all kinds of pavements for streets or sidewalks by Wm. W. Gooch, Millard F. Tompkins, Jas. B. Mackie, Ralph B. Crummy and Kenneth K. McLaren.

BRICK.

West Hamburg, Pa.—The entire plant of the Hamburg Vitrified Brick Works was destroyed by fire recently, entailing a loss of $30,000. The plant was owned by the Mack Paving Brick Co., of Philadelphia. It will be rebuilt.

Phillipsburg, N. J.—The Lehigh Granite Brick Co. has been incorporated by Howard E. Seyfried, Henry Wentz, F. C. Wolfe and R. E. Wentz. The company will manufacture sand-lime brick and other sand-lime products.

South Webster, O.—Local men have organized the South Webster Brick Co., and will manufacture fire and paving brick. The company expects to have its plant in readiness in a very short time. The officers are: President, Dr. Walter E. Rancheous; vice-president, F. W. Schoeffer; secretary and treasurer, Harry W. Strong; general manager, J. A. Stout.

Steubenville, O.—The Ohio Valley Clay Co. has been incorporated by J. W. Gill, R. L. Brownlee, G. W. McCook, S. C. Gill and J. J. Gill.

The Terre Haute Vitrified Brick Co. is the new name of the Terre Haute Brick and Pipe Co. Will P. Blair is secretary.

CEMENT.

Alpena, Mich.—At the annual meeting of the Alpena Portland Cement Co., Walter S. Russell, of Detroit, was chosen a director. The officers are: President, Herman Besser; vice-president, George B. Holmes; secretary, C. H. Reynolds; treasurer, William H. Johnson. Reports were presented at the meeting showing that the company's output last year was 340,000 barrels.

Toledo, O.—The Wyandotte Portland Cement Co. notified the board of public service, January 2, that in the future rebates for cloth bags returned the company by the city will be cut from 10 to 7½ cents. Press reports state that the board will doubtless continue the policy of the former directors, and receive bids for all cement purchased.

New York City.—Special.—F. L. Smidth & Co., cement engineers and makers of cement machinery, 41 Cortlandt st., advise us that they have recently taken orders for 17 of their large size tube mills for the Pacific Portland Cement Co., of California; 24 kominuters and tube mills for the new plant at Fogelsville, Lehigh Co., Pa., for the Lehigh Portland Cement Co. They are also installing 3 additional kominuters at the mill "B" plant of the Lehigh company.

Mason City, Ia.—Special.—A. F. Shotts desires the names of some good engineering firms who erect cement plants and can give approximate costs of same. A plant is proposed here.

Dixon, Ill.—Special.—Fuller Bros. advise us that the lime rock and clay deposits discovered recently are valuable for the manufacture of a high grade of cement. The Sandusky Portland Cement Co. has purchased 300 acres of land near Dixon, and will build a $1,000,000 plant this year.

Trenton, N. J.—The Crown Cement Works Co., 147 E. State st., has been incorporated to manufacture Portland and other cements, lime, limestone, plasters and artificial stone, by H. H. McClure, George R. Work and E. Kern.

Charleston, S. C.—The Standard Portland Cement Co. has been incorporated and will manufacture Portland cement, having a daily capacity of 1,000 barrels.

Florence, Colo.—At the annual meeting of the stockholders of the Portland Cement Co., of this city, held at Pueblo, January 11, an expenditure of $100,000 was authorized to increase the output of the cement works and for the purchase of

new machinery. The directors elected officers as follows: President, Charles Boettcher; vice-president and treasurer, M. D. Thatcher, Pueblo; secretary, R. J. Morris, Denver; general manager, Whitney Newton, Pueblo.

Wellston, O.—The Alma Cement Co. has just had constructed at its plant two new stock houses.

Mason City, Ia.—A fund is being raised for a stock subscription of $42,000, which is a condition for the establishment of the proposed cement mill here, at a cost of $2,000,000.

Trade in American Portland cement to ports on the River Plate, in South America, including the Argentine trade, labors under several disadvantages, of which there is no present prospect for removal. They are the higher freight rates, those from New York being $4.80 per gross ton, while those from Hamburg are $3 to $3.20; the higher cost of manufacture in America, which, though small, is of importance when competing in foreign markets, and the fact that the high import tariffs cause the loaded vessels to travel south, so that the vessels in ballast are going the wrong way to be utilized for bulk freights like cement. American enterprise should be able to remove these difficulties by taking the steps indicated by their nature.

CONCRETE BLOCKS.

Toledo, O.—The new plant of the Toledo Cement Block Co., at Lafayette st. and Swan creek, has been completed and the installation of machinery begun. A. J. Johnson and W. A. Cutler own the plant.

New York City.—The New York Concrete Block, Sand, Lime & Brick Co. has been incorporated to manufacture brick, stone, concrete, etc., as follows: William C. Foster, 34 Nassau st.; Benjamin Merklen, Jr., 49 Wall st.; Robert C. Bokerhan, 135 William st.

Spokane, Wash.—The Montana Cement & Lumber Co. has been incorporated by H. M. Thacher and A. E. Gallagh, and the marl deposits near Eureka, Mont., will be developed.

Houston, Tex.—The Concrete Construction Co. has been incorporated by H. W. Cortes, H. N. Jones and C. L. Burns.

Camden, N. J.—The Cumberland Reinforced Concrete Co., 419 Market st., has been organized and will engage in concrete work. The incorporators are John MacPeak, G. H. B. Martyn and F. R. Hansell.

Dayton, O.—The Gem City Concrete Block Co. held its annual meeting Jan. 3, in the Arcade building, and elected directorfs as follows: W. L. Blocher, Philip A. Kemper, Charles Heck and John P. Kemper.

Milwaukee, Wis.—The Fred Rheins Cement & Concrete Company has been incorporated by Fred Rheins, Mary R. Rheins and Arthur C. Rheins.

Yankton, S. D.—E. T. Lamb will engage in the manufacture of cement blocks here.

Enderlin, N. D.—The North Dakota Concrete Co. has begun the manufacture of concrete blocks.

Willmar, Minn.—Nelson Bros. Paving & Construction Co., of St. Paul, have purchased the interests of A. P. Bergeson, of this city.

Goldendale, Wash.—Markle Bros. & Paarz have installed a plant for the production of concrete blocks, sewer and irrigation tile.

Beatrice, Neb.—L. B. Faus, of LeMars, Ia., has moved here and will engage in the cement business.

Orangeburg, S. C.—The General Mfg. Co. has been incorporated and will establish a plant for the manufacture of cement products.

Asheville, N. C.—C. H. Miller has begun the manufacture of concrete building blocks, and the organization of a company for manufacturing the product on a more extensive scale is being considered.

Fairfield, Ia.—J. L. Young has established a block factory here.

Stanley, N. D.—C. F. Kale, of Walkerton, Ind., will engage in the manufacture of concrete blocks here.

Rockwell, Ia.—M. Knapp has constructed a machine for making cement blocks for chimney construction.

Minneapolis, Minn.—Nels Erickson, for merly with the Winner Block Co., has become associated with the Medium Hollow Block Co., with offices at 419 Boston Blk., this city.

New York City.—Special.—A. C. Horn advises us that he has purchased the interest of Mr. August Gross in the assets and business of Gross & Horn, manufacturers of waterproofing compounds, and will continue the business as successor to that firm at the same address, 249 Front st.

Columbus, O.—The Iron City Brick Co. has been incorporated by W. D. Brickell, David C. Meehan, Allen R. Rapp, C. J. Near and G. J. Marriott.

Rutland, Vt.—W. E. Patch, of Akron, N. Y., has purchased land south of this city and will soon build a plant for the manufacture of cement building blocks.

Alliance, O.—The Garfield Brick Co. has decided to install machinery in its plant for the manufacture of roofing and drain tile building blocks and concrete conduit tile.

Albany, N. Y.—The Albany Material and Construction Co. is being organized for the manufacture of hollow concrete building blocks. U. G. Stockwell, president.

Cambridgeport, Mass.—The New England Adamant Securities Co. has been incorporated to deal in cement. President, Mitchell H. Sullivan, 48 Hewitt st., Dorchester, Mass.; treasurer, Charles King, Johnston, N. Y. city; clerk, C. S. Leighton, Cambridgeport.

La Junta, Col.—The La Junta Concrete Block and Supply Co. has been incorporated by K. H. Kirkpatrick, R. E. Fisha, W. E. McCarthy, Etta Buckey and C. R. Buckey.

Milwaukee, Wis.—The Fred Rheins Cement and Concrete Co. has been incorporated by Fred Rheins, Mary Rheins and Arthur C. Rheins.

Batesville, Ark.—R. H. Myers & Co. have begun the erection of a plant for the manufacture of concrete building material.

Elyria, O.—The Elyria Builders' Supply Co. has been incorporated by George Fronly, H. J. Neipfoot, C. M. Runyan, F. C .Wolf and Frank A. Smith.

Pittsburg, Pa.—The American Refractories Co. has been incorporated to manufacture and deal in brick, fire-proofing, clay products and refractory materials, by Daniel M. Kirk, B. J. Jarrett, E. P. Griffith, M. J. Cohan, of Pittsburg, and W. W. McVeill, of Allegheny.

LIGHT, HEAT AND POWER.

Newly incorporated companies:

Washington, N. J.—Washington Electric Co.—William H. Houston, William W. Lavering, William R. Greene, all of Philadelphia.

Norfolk, Va.—J. W. Smith Electric Co.

Rising Star, Tex.—Rising Star Electric Light Co.—H. E. and W. E. Anderson and W. A. McSpadden.

Chicago, Ill.—Allen Electric Co.—Warren M. Wolls, Frank G. Todd, Theo. H. Schlader.

Chicago, Ill.—Electric Contracting Co.—John Burns, John V. Healy, Charles L. Caswell.

Chillicothe, Ill. — Chillicothe Water, Light & Power Co.—W. H. Foster, Frank H. Earl, Charles A. Kingsbury.

Oconto, Wis.—Oconto Electric Co.—Wm. H. Young, Truman H. Phelps, Albert Fulton.

Patchogue, N. Y.—Rossiter, MacGovern & Co., to construct electric plants—John C. Brackenridge, Frank MacGovern, 17 Battery Place, New York City; James R. Floyd, Jr., Nyack, N. Y.

Montclair, N. J.—Hill-Wright Electric Co.—F. T. Hill, Emeline Wright, Alfred A. Wright.

Glenwood, Wis.—Glenwood & Downing Light & Power Co.—Fred T. Yates, Virginia A. Yates, F. W. Downes.

Pennsboro, W. Va.—Hope Electric Co., to construct and equip electric plants.

Hennessey, Ok.—Hennessey Electric Light, Power & Ice Co.—Fred Ehler, J. W. Smith, C. C. Smith.

Chicago, Ill.—Tietgen, Falk & Co. has been organized here to manufacture electrical fixtures, by Edward Tietgen, Louis Falk and Louis Severus.

PROPOSED PURCHASE OF MACHINERY.

Philadelphia, Jeff. Co., N. Y.—Special.—A. F. Nims advises us that he is in the market for machinery and tools for general municipal contracting and railroad construction.

Batesville, Ind.—Special.—Koepfle Bros. advise us that they desire to purchase metal concrete molds, etc.

Minneota, Minn.—Special.—S. W. Jonason advises us that he desires to purchase cement block machinery and mixers.

Schenectady, N. Y.—Special.—Elmer E. Stanton, 74-75 Parker Bldg., desires to purchase the entire equipment for a clay brick plant. He will also sell his entire concrete equipment. He desires competent men as superintendents, as he has six plants in operation.

Camilla, Ga.—Special.—W. W. Cullens advises us that he desires to purchase machinery and tools for making cement brick, hollow blocks and all concrete work.

Harrisburg, Pa.—Special.—Bergham & Moffitt, 200 Pine st., are interested in the purchase of machinery and tools for constructing macadam roads, brick and block street paving, sewers of all kinds, grading (electric railway and street), reinforced concrete bridges, and laying water mains. They are also interested in the purchase of crushed stone, c. i. pipe, c. i. culvert pipe, cement, structural iron, vitrified brick, stone and asphalt blocks, terra cotta pipe, drain tile, expanded metal, carts, wagons and tools.

Edinburg, S. D.—Special.—Seder C. Lee desires to purchase machinery and tools for making concrete blocks and sewer pipe.

Fullerton, Neb.—Special.—E. M. La Grange advises us that he is in the market for tools and machinery for cement walks, cement blocks, fence posts and brick and block machines.

Rushville, Ind. — Special. — Allen R. Holden is in the market for cement block machines, mixers, etc.

Chicago, Ill.—Special.—P. C. Lesterhouse, 119 W. 109th st., Roseland, advises us that he desires to purchase machinery and tools for making cement blocks and basement floors.

Dallas, Tex.—Special.—R. E. L. Shaw, 31 Gaston Bldg., is in the market for machinery and tools for bridges.

Kenosha, Wis.—Special.—H. G. Butler, 670 Prairie ave., is in the market for machines for making cement blocks and cement burial caskets.

Sioux Falls, S. D.—Special.—J. T. Summers, Box 117, desires to purchase a concrete mixer.

Kewanee, Ill.—Special.—Charles William McFarland, 823 Columbus ave., desires to purchase a sand elevator.

West Union, Ia.—Special.—Jacob L. Johnson is in the market for machinery and tools for making building and paving blocks and sewer pipe.

Hartford, Mich.—Special.—Louis Kime advises us that he is in the market for cement block machines.

Dallas, Tex.—Special.—O. J. Gorman, 123 St. Louis st., advises us that he expects to be interested in the purchase of machinery and tools for making concrete building blocks and cement brick.

Princeton, Wis. — Special. — Bert H. Shew desires to purchase a brick machine.

Hopkinsville, Ky.—Special.—H. C. Dalton is in the market for engines, boilers and rock crushers.

Port Huron, Mich.—Special.—Andrew J. Murphy desires to purchase a concrete mixer.

New Castle, Ind.—Special.—F. M. Price desires to purchase machinery and tools for making blocks, brick and posts, and cement finishing tools.

Watertown, S. D. — Special. — L. E. Brickell advises us that he desires to purchase a band saw machine, a 6 or 8-in. four-side molding machine—a good second-hand machine will do—and a concrete mixer.

Benton, Ark.—Special.—The Arkansas Concrete Stone Co. desires to purchase a crusher for crushing medium small gravel.

Tulsa, Ok.—Special.—C. O. Frye, prest. Tulsa Cement Stone Mfg. Co., advises us that he desires to purchase a street roller, an automatic electric tamper and cement block machinery.

Council Bluffs, Ia.—Special.—W. S. Cooper, 125 Fairview ave., desires to purchase cement post and cement block machines.

Painesville, O.—Special.—The Lake Erie Concrete Co. is in the market for cars and track to equip their plant, and for a concrete mixer.

Coopertown, N. D.—Special.—A. E. Carlander contemplates putting in a cement brick machine this spring.

Rennselaer, N. Y.—Special.—Chas. S. Finkle 1506 Broadway, advises us that he intends in the spring to erect a large plant and will want mixers, power to run them, etc.

Baltimore, Md.—Special.—W. W. Crosby of Johns Hopkins University, advises us that he may purchase tools and machinery for paving and roadmaking.

Denver, Colo.—Special.—M. R. Bump, of the Gas & Electric Co., 405 17th st., may purchase machinery and tools for tar pavements.

Oberlin, O.—Special.—The Oberlin Concrete Co. desires to purchase machinery for making concrete blocks and brick.

LaConner, Wash.—Special.—J. C. Foster advises us that he is interested in work for which machinery and tools may be purchased for the mining and milling of tale.

Waterloo, Ia.—Special.—The Waterloo Cement Machinery Co. advises us that it is in the market for all kinds of iron-working machinery, motors and anything that is required to put in a first-class machine shop.

Cartersville, Ga.—Special.—A. S. Brevard, chmn. sts., desires to purchase machinery and tools for constructing good streets, walks, sewerage and drainage.

Moundsville, W. Va.—Special.—William Donley, 1117 7th st., desires to purchase a block machine.

Augusta, Me.—Special.—W. W. Jackson, 39 Jefferson st., advises us that he is in the market for machinery and tools for concrete work and general building.

Fairbury, Neb.—Special.—B. W. McHale desires to purchase a cement mixer, gasoline engine, molds for making cement sills and caps, and tools for sidewalk and curbing.

Goderich, Canada. — Special. — M. O. Johnson, town clk., desires to purchase machines for making cement tiles.

Greenup, Ill.—Special.—C. C. Legget, Box 165, desires to purchase concrete block and brick machines.

Iowa Falls, Ia.—Special.—The Standard Stone Co. advises us that it desires to purchase machinery and tools for making cement blocks, sidewalks, tanks, etc.

Narragansett Pier, R. I.—Special.—John Bristow, general contr., advises us that he has been considering the purchase of a cement block machine for some time, but cannot make up his mind which one he wants. He states that if any machines are in operation within 100 mls. of Narragansett Pier he desires information to that effect, so that he can see them in operation.

Paris, Tex.—Special.—J. J. Cunningham advises us that he desires to purchase small cement laboratory equipment for tests.

Narraganset Pier, R. I.—Special.—John Bristow desires to purchase machinery and tools for stone crushing, road building and construction work in general.

Girard, Ill.—Special.—A. O. K. Young, Box 264, advises us that he desires catalogues of a concrete sewer pipe machine.

Boise, Idaho. — Special. — Zenas M. Vaughn, cy. engr., advises us that he will soon be in the market for a simple outfit for the testing of cements, and states that he will want to make most of the tests that are enumerated in our Handbook for Cement Users, except possibly those for tensile and compressive strength.

Reno, Nev.—Special.—A. F. Niedt, cement and paving contr., 109 Ralston st., desires to purchase a second-hand concrete mixer.

Cunningham, Kas. — Special. — J. B. Thompson desires to purchase molds for making concrete blocks and a hand-batch mixer.

Billings, Mont.—Special.—Yegen Bros. advise us that they are about to construct a stucco plant of 100-ton capacity, and will be ready to invite bids for the necessary machinery within a short time.

Monmouth, Ore.—Special.—Frank Lucas advises us that he is to take charge of the sale of the Modern Stone Company's cement products at Portland, Ore., in a short time, and desires information on the subject of concrete building blocks.

Spencerville, O.—Special.—I. B. Gayer advises us that he desires to purchase concrete mixing machinery for bridge and foundation work.

Jersey City Heights, N. J.—Special.—Richard J. MacLachlan, 100 Sherman Place, desires the names and addresses of firms manufacturing machines and molds for artificial stone or cement blocks.

Greencastle, Ind.—Special.—G. B. Parker, 908 Crown st., advises us that he is in the market for a cement block machine.

Holly, Colo.—Special.—J. H. Snyder, Box 23, desires to purchase machinery and tools for making cement blocks, posts, etc.

PURCHASE OF MATERIALS.

Minneota, Minn.—Special.—S. W. Jonason desires to purchase cement and lumber.

Camilla, Ga.—Special.—W. W. Cullens is in the market for cement and gravel.

Perkiomenville, Pa.—Mr. James M. Smith, contractor, is in the market for 1,000 barrels of Portland cement.

Harrisburgh, Va.—H. C. Tankey, 29 West Water st., has requested prices on Portland cement; he does not state how many barrels he requires.

Council Bluffs, Ia.—Special.—W. S. Cooper, 125 Fairview ave., is in the market for cement.

Painesville, O.—Special.—The Lake Erie Concrete Co. is in the market for about 3,000 barrels of cement.

New Castle, Ind.—Special.—F. M. Price advises us that he desires to purchase Portland cement, etc.

Brainerd, Mont.—Special.—A. Everett advises us that he desires to purchase cement.

West Union, Ia.—Special.—Jacob L. Johnson desires to purchase cement.

Oneonta, N. Y.—Special.—C. A. Hodge, 52 Cedar st., desires to purchase cement.

Hartford, Mich.—Special.—Louis Kime is in the market for cement.

Princeton, Wis.—Special.—Bert H. Shew desires to purchase cement.

Sioux Falls, S. D.—Special.—J. T. Summers, Box 117, advises us that he is in the market for cement in car lots.

Kewanee, Ill.—Special.—Charles William McFarland, 823 Columbia ave., is in the market for plaster, cement and lime.

Edinburg, S. D.—Special.—Seder C. Lee is in the market for cement.

Rushville, Ind. — Special. — Allen R. Holden is in the market for cement.

Chicago, Ill.—Special.—P. C. Lesterhouse, 119 W. 109th st., Roseland, advises us that he desires to purchase cement, crushed stone and sand.

Harrisburg, Pa.—Special.—Berghans & Moffitt, 200 Pine st., advise us that they desire to purchase crushed stone, c. i. pipe, c. i. culvert pipe, cement, structural iron, vitrified brick, stone, asphalt blocks, terra cotta pipe, drain tile, expanded metal, etc.

Holly, Colo.—Special.—J. H. Snyder, Box 23, is in the market for cement.

Greencastle, Ind.—Special.—G. B. Parker, 908 Crown st., advises us that he is in the market for cement.

Cunningham, Kas. — Special. — J. B. Thompson desires to purchase Portland cement.

Fremont, Neb.—Special.—R. Whitfield, 6th and M sts., advises us that he is in the market for cement.

Greenup, Ill.—Special.—C. C. Leggett, Box 165, desires to purchase cement.

Nashville, Tenn.—Special.—John Oman, Jr., Oak and High sts., is in the market for cement.

Upper Sandusky, O.—Special.—John Aungst advises us that he is in the market for materials for building walls and blocks.

Moundsville, W. Va.—Special.—William Donley, 1117 7th st., desires to purchase Portland cement.

Rensselaer, N. Y.—Special.—Charles S.

Kinkle, 1506 Broadway, desires to purchase cement.

Oberlin, O.—Special.—The Oberlin Concrete Co. desires to purchase cement, lime, sand, limestone, etc.

MISCELLANEOUS.

Mt. Vernon, N. Y.—The Mount Vernon Interurban Real Estate & Construction Co. has been incorporated to construct buildings, bridges, etc., by J. Willet Fox and James M. Thompson, of Yonkers, and A. Murray Jenks, of this city.

Camden, N. J.—The Standard American Dredging Co. has been incorporated to do dredging, excavating, engineering and contracting, by C. F. Cobbledick, W. L. Paulson and J. S. Spillman.

Rockford, Ill.—The Rockford-Kalamazoo Fire Extinguisher Co. has been organized and incorporated by Edgar E. Bartlett, Paul F. Schuster and R. K. Welsh.

Chicago, Ill.—The Globe Trenching Machine Co. has been incorporated here to manufacture machinery, by A. J. Pflaum, Sylvanus G. Levy and Benjamin Samuels.

Oklahoma City, Ok.—The National Continuous Concrete Machine Co. has been incorporated by John W. Wilson, as president; J. E. Pitts, vice-president; R. A. Barnes, secretary and treasurer. John W. Wilson, president of the company, invented a machine for laying continuous tile and water pipe or other continuous work of concrete.

St. Louis, Mo.—The Thiele Garbage Box Mfg. Co. has been incorporated to manufacture and sell garbage boxes, to erect or buy reduction plants, to buy or otherwise acquire garbage, to haul, reduce and utilize garbage—Walter L., F. M. and J. Thiele.

New Paris, O.—Reinheimer Bros. are running their stone quarry to its full capacity to fill a large order for Warren Brothers Company, of Boston, Mass., who will take the entire output for year.

Empire, O.—Stratton Bros. are running both the Ohio River and Stratton fire clay plants night and day. The new Great Northern Works at Stratton, a new town near here, is nearing completion.

Toronto, O.—The Myers Fire Clay Co. will continue running during the winter.

Toledo, O.—The Kelly Island Lime and Transport Co. has purchased the plant of the Toledo White Lime Co. The local office has been abandoned and the plant at White Rock, about 12 mis. from Toledo, has been doubled.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Akron, O.—M. J. J. Mahoney, a new member of the Board of Public Service, presented a resolution to the board Jan. 22 to amend the specifications for brick paving by permitting either paving brick or repressed brick to be used, and to eliminate the clause of the specifications requiring that the material be burned in "down-draft kilns or furnaces."

CONTEMPLATED WORK.

Elgin, Ill.—The paving of National st. is proposed.

Oskaloosa, Ia.—Paving is proposed for 7 blocks of alleys.

Sterling, Ill.—E. Third, Locust and W. Third sts. will be paved.

Houston, Tex.—McKinney and McGowen sts. are to be paved.

Rochester, N. Y.—Paving is contemplated for East ave. and Cortland st.

Buffalo, N. Y.—Council decided Jan. 17 to pave Curtiss st. with asphalt.

Norfolk, Va.—Paving is contemplated for Queen st. W. T. Brooks, cy. engr.

Seaside, Ore.—A 6-mi. boulevard is contemplated by the Council of West Seaside.

Scranton, Pa.—Asphalt paving is contemplated for Dupont court.

Toronto, O.—This city will pave three streets in the lower part of the city in the spring.

Jersey City, N. J.—Specifications have been adopted for improving Wilkinson ave.

Redding, Cal. — The question of constructing cement sidewalks is being considered.

Alexandria, Va. — The committee on streets is considering a petition for paving Union and Princess sts.

Standish, Mich.—The question of improving roads in Mason and Turner twps. is being considered by the supervisors.

Winona, Minn.—The question of macadamizing W. Broadway is being considered.

Bay City, Mich.—The paving of Broadway as far as Fremont ave. is being considered.

Peoria, Ill.—Plans have been accepted for paving 3 streets with brick and asphalt.

Portland, Ore.—Paving is contemplated for Union ave., Burnside and E. Burnside sts.

Tulsa, I. T.—Estimates will be made and bids asked for paving First st. with asphalt.

Waterloo, Ia.—The property owners on Washington st. contemplate paving next season.

Uniontown, Ala.—The citizens have voted to expend $20,000 in the construction of apving.

Pendleton, Ore.—An ordinance has been passed providing for the paving of E. Court st.

Dallas, Tex.—Paving is proposed for Orr and Hughes sts. and brick paving for Gaston ave.

Newburgh, N. Y. — Plans for paving

Lander st. have been prepared. Everett Garrison, cy. engr.

La Crosse, Wis.—Council is considering petitions for brick and macadam paving on several streets.

Bay City, Mich.—The residents of Belinda st. are still urging the question of paving.

Ann Arbor, Mich.—About 10,000 sq. yds. of brick paving is contemplated. E. W. Groves, cy. engr.

Pentwater, Mich.—Plans have been prepared for about 26,000 sq. yds. of paving in various townships.

Grand Rapids, Mich.—Brick paving is contemplated for Stocking st. from W. Bridge st. to Seventh st.

Wichita, Kan.—A resolution has been passed for paving Lawrence ave. with brick. H. J. Harding, cy. engr.

Albany, N. Y.—Plans have been prepared for constructing a new macadam road from this city to Schenectady.

Norwood, Pa.—Boro Council has adopted an ordinance to improve the streets and make sewer extensions.

Effingham, Ill.—Estimates will be prepared for paving Jefferson st., and the contract will be let in March.

Kent, O. — Estimates have been prepared for paving E. Main st. from Water to Lincoln. Fred Bechtel, vil. clk.

St. Joseph, Mo.—Repaving with macadam is contemplated for Olive, 15th and Faraon sts. and Savannah ave.

Rock Island, Ill.—Asphalt paving is contemplated for 16th st. from 10th to 12th ave. H. C. Schaffer, cy. clk.

El Reno, O. T.—Council has decided to pave Rock Island and Bickford aves. and Hayes, Woodson, Russell and Wade sts.

Harrisburg, Pa.—Ordinances are proposed providing for about 20,000 sq. yds. of paving. M. P. Cowden, cy. engr.

Hattiesburg, Miss. — Special. — Richard C. Huston, cy. engr., says about $150,000 will be expended on street paving.

Jeffersonville, Ind.—The contract will be let soon for constructing 12¼ mis. of macadamized road in Jefferson county.

Belleville, Ill.—Ordinances have been passed for paving B and E. Main sts. with brick. L. L. Harper, cy. engr.

Green Bay, Wis.—City Engr. Reed is preparing plans and specifications for asphalt paving on Main, Washington and Pine sts.

St. Paul, Minn.—Bids will be asked for in February or March for macadamizing University ave. L. W. Rundlett, cy. engr.

Normal, Ill. — An ordinance has been passed providing for paving Fell ave. from Locust to Division sts. with brick block.

Cleveland, O.—Plans have been prepared for constructing the proposed new Edgewater-Brookside boulevard south of Lorain ave.

York, Pa.—Common Council passed on first reading bills for paving on College and Cleveland aves., Water, Lafayette and Cherry sts.

Houston, Tex.—The stockkholders of the Hyde Park Improvement Co. have decided to pave Euclid ave. and construct additional sidewalks.

Detroit, Mich.—This city contemplates the construction of asphalt cedar-block and brick paving on a large number of streets this year.

Denver, Col.—Plans and specifications have been prepared for paving a number of streets in District No. 1. G. E. Randolph, prest. B. P. W.

Watseka, Ill.—Special.—R. L. Harrell, cy. engr., says the Board of Local Improvements has passed a resolution to pave about 5 mis. of streets with macadam.

Lexington, Ky.—This city contemplates the construction of 12,000 sq. yds. of creosoted-block paving. J. White Guyon, asst. cy. engr.

Hartford, Conn.—The Board of Aldermen voted in favor of constructing a highway across Pope Park from Laurel st. to connect with Hillside ave.

Washington, D. C.—The extension of the asphalt paving on Massachusetts ave. west of Sheridan circle is advocated by John Biddle, Dist. Comnr.

Racine, Wash.—The question of paving Washington ave., Hamilton, Marquette, Seventh, W. Sixth and Wisconsin sts. and Lafayette ave. is being considered.

Portsmouth, O.—The residents on Lawson st. from Eleventh st. to Robinson ave. are in favor of paving. Paving is also desired on Eighth st., in Earlytown.

Orange, N. J.—Plans for about 11,700 sq. yds. of macadam paving have been prepared and bids will be asked about March 5. Fred T. Crane, cy. engr.

Trenton, N. J.—Ordinances have been passed providing for the paving of E. State st. from Monmouth st. to the city line with asphalt. C. C. Haven, cy. engr.

New Orleans, La. — Ordinances have been favorably reported for paving with asphalt Union, Joseph, Baronne, Prytania and Iberville sts. and St. Roch ave.

Warren, O.—The business men on Main and Market sts. have petitioned for the paving of the alleys in the rear of their places.

Delaware, O.—About 7,000 sq. yds. of paving and 2,500 lin. ft. of curbing is contemplated on Sandusky st., according to press reports. J. S. Dike, cy. engr.

Oklahoma City, O. T.—Plans and specifications have been adopted and bids will be asked for paving N. Robinson ave., 13th st. and Brodaway. W. C. Burke, cy. engr.

Buffalo, N. Y.—The street committee has reported favorably on paving as follows: Asphalt, James st.; brick, Montgomery and Clare sts.; repaving, Whitney place.

Syracuse, N. Y.—W. Onondaga st. will be paved for a distance of 2 mis., the Council to decide the use of asphalt, brick or block. Frank J. Schnauber, cy. engr.

Boise, Ida.—Mayor Pinney, in his message, advocates a system of paving for Front, Grove, Bannock and Jefferson sts., and a macadam road to the City Cemetery.

Savannah, Ga.—Paving is contemplated for Barnard and Montgomery sts. and Bay lane. The residents on Gaston st. have asked for asphalt paving instead of brick.

Portland, Me.—Bitulithic paving is contemplated for Federal, Mountfort and North sts., macadam for St. Lawrence, Waterville, Atlantic, Wilson and Saunders sts., granite for certain streets.

Cambridge, O.—Council has decided to pave N. Tenth st. with asphalt and N. Eighth, S. Ninth, S. Eighth, Fourth and S. Eleventh sts. and Steubenville ave. with vitrified brick. C. L. Blackburn, clk. Council.

New Albany, Ind.—E. B. Coleman, cy. engr., has been directed to prepare plans and specifications for paving W. Main, Spring, Market, Vincennes and State sts. with vitrified brick or asphalt.

St. Paul, Minn.—Estimates have been prepared for paving Second st. from Wabasha to Jackson with vitrified brick, creosoted blocks, sandstone, granite or sand-lime brick. L. E. Rundlett, cy engr.

Concord, N. H.—Under the provisions of the highway law of 1905 the Governor

and Council and selectmen of 50 towns have designated the state roads upon which the joint state and town appropriation for permanent highway improvements are to be made.

Terre Haute, Ind.—The civic committee of the Young Business Men's Club decided Jan. 20 to start a subscription to aid in the proposed paving of the Macksville grade, the portion of the National road between the Wabash river and West Terre Haute.

Freeport, Ill.—Special.—G. W. Graham, cy. engr., says ordinances were passed Jan. 15 for proposed paving as follows: Pleasant st. and Broadway, 31,155 sq. yds. of macadam paving and 16,744 lin. ft. curb and gutter, $26,901.35; Clark ave., 10,449 sq. yds. macadam paving, 7,256 ft. curb and gutter, $9,300; Van Buren and Spring sts., 44,339 sq. yds. brick paving and 19,338 ft. curb and gutter, $87,300.

CONTRACTS TO BE LET.

Manistee, Mich.—Bids are asked until March 1 for street paving.

Troy, O.—Bids will be asked about March 1 for five blocks of brick paving. H. J. Walker, cy. engr.

Brazil, Ind.—Bids are asked until Feb. 9 for constructing 15,700 ft. of road. J. Frank Smith, co. audt.

Independence, Kan. — Bids are asked until Feb. 13 for paving and curbing Tenth st. T. N. Sickels, cy. clk.

Perth Amboy, N. J.—Sealed bids are asked until Feb. 5 for grading Kirkland place. W. Fullerton, st. comr.

Moline, Ill.—Bids will be asked about March 1 for asphalt street paving. Clark G. Anderson, cy. engr.

New York City.—Bids are asked until Feb. 8 for grading several streets in Bronx boro. L. F. Haffen, boro prest.

Rockkville, Ind.—Bids are asked until Feb. 5 for constructing and bridging two gravel roads. Henry Grubb, co. audt.

Clinton, Ia.—Sealed bids are asked until Feb. 7 for macadamizing part of the Ridge road and Elvira road. Frank W. Leedham, co. audt.

Jefferson Barracks, Mo.—Bids are asked until Feb. 4 for constructing roads, walks and grading. W. C. Cannon, Q. M.

Winamac, Ind.—Bids are asked until Feb. 6 for improving and building 12 mis. of road in Franklin twp. Bd. Co. Comrs.

Geneseo, Ill.—Bids will be asked about April 10 for constructing 100,000 sq. ft. of cement sidewalks. C. O. Harper, cy. clk.

Wenatchee, Wash.—Bids are asked until March 1 for constructing state road No. 3, known as Red Mountain State road. Co. Comrs.

Fargo N. D.—Bids will be asked about March 1 for paving Broadway with creosoted wood blocks on concrete. Cy. Engr. Crabbe.

Greensburg, Ind.—Sealed bids are asked until Feb. 5 for macadamizing W. A. Craig road, New Pennington road and Patrick road. Frank E. Ryan, co. audt.

Columbus, Ga.—Bids are asked until Feb. 5 for 5,000 sq. yds. of vitrified brick or bitulithic paving on Tenth and Eleventh sts. W. C. Campbell, supt. pub. wks.

Danville, Ind.—Sealed bids are asked until Feb. 5 for constructing and improving certain roads. Albert Murphy, chmn. co. comrs.; David D. Mills, co. audt.

Rhinelander, Wis. — Sealed bids are asked until Feb. 15 for paving a large number of streets with macadam, with cement curb and gutter. Richard Reed, chmn. B. P. W.

Cincinnati, O.—Sealed bids are asked until Feb. 9 for placing crushed stone on Mt. Airy road between Colerain pike and North Bend road. C. C. Richardson, co. audt.

Sullivan, Ind.—Sealed bids are asked until Feb. 6 for constructing 15,185 ft. of stone road in Hamilton twp. Joseph Asbury, chmn. co. comrs.; E. E. Russel, co. audt.

St. Paul, Minn.—Sealed bids are asked until Feb. 5 for macadamizing Lexington ave. from Minneapolis ave. north to Station 156 and New Brighton road. Edward G. Krahmer, co. audt.

Belle Fourche, S. D.—Sealed bids are asked until Feb. 6 for furnishing from 20,000 to 30,000 bbls. of Portland cement here. R. F. Walker, engr. Belle Fourche, Reclamation Service, Washington, D. C.

Roanoke, Va. — Bids are asked until Feb. 10 for constructing brick paving on Front and Henry sts. and Norfolk and Campbell aves.; for macadamizing 3,000 ft. of Third, Jefferson and Thirteenth sts. W. B. Bates, cy. engr.

Little Rock, Ark.—Sealed bids are asked until Feb. 14 for paving Main st. from Eighth to Twenty-fourth with vitrified brick on concrete base, asphalt on concrete, and bitulithic. Guy E. Thompson, sec. comrs. impvt.

Perth Amboy, N. J.—Sealed bids are asked until Feb. 5 for constructing creoresinate wood block, vitrified brick or Warren's bitulithic pavement on a number of streets, aggregating 18,000 sq. yds. Wm. Fullerton, st. comr.

Bloomington, Ind.—Bids are asked until Feb. 5 for constructing Wood's Ferry gravel road in Van Buren twp, Parks Schoolhouse gravel road in Bloomington twp., J. D. Showers gravel road in Bloomington twp. S. M. Kerr, co. audt.

Lawrence, Kan.—Bids are asked until Feb. 5 for improving several streets, consisting of the following: Grading, 12,000 cu. yds.; limestone curbing, 7,000 lin. ft.; vitrified brick paving, 33,000 sq. yds. F. D. Brooks, cy. clk.

Houston, Tex.—Sealed bids are asked until Feb. 14 for paving from West La Porte Depot to Morgan's Point; 1 mi. on Leeland ave. road, 2¼ mis. on Katy road; 1,000 ft. where E. Montgomery road crosses Green's bayou. John B. Ashe, co. audt.

Crookston, Minn.—Bids are asked until March 13 for paving Houston ave. from Ash st. to Carman bridge, consisting of the following: Asphalt pavement, 6,818 sq. yds.; 3-in. tile drain, 3,578 lin. ft.; artificial combined curb and gutter, 2,441 lin. ft. J. E. Carroll, city engr.

CONTRACTS AWARDED.

Chattanooga, Tenn.—The Southern Paving and Construction Co. was awarded paving work here for $7,894.

Little Rock, Ark.—The Arkansas Rock Asphalt Co. was awarded the contract for paving W. Eighteenth st. for $9,250.

Knox, Ind.—Prettyman & Gibbs secured the contract for constructing about 20 mis. of gravel roads in Stark co.

San Francisco, Cal.—C. S. Harney was awarded the contract for paving Fourteenth st. from Howard to Freelon, for $26,034.15.

Cleveland, O.—The contract for paving Coe Ridge road was awarded to the Ohio Engineering Co., of Lorain, for $174,000.

Independence, Mo. — The contract for grading 1¼ mis. of Blue Springs and Tarsney roads was awarded to J. C.

Brown at 15 cts. a cu. yd. for excavation and $3.75 a cu. yd. for culvert masonry.

Toledo, O.—The contract for paving Madison ave. from Summit to St. Clair sts. was awarded to Henry P. Streicher, for $3,628.

Niagara Falls, N. Y.—The contract for paving Nineteenth st. was awarded Jan. 16 to Henry P. Burgard, of Buffalo, at $1.75 a sq. yd., or $40,000.

St. Paul, Minn.—The Barber Asphalt Paving Co. secured the contract for paving E. Fifth st., and the Portland Stone Co. the contract for curbs and gutters on Inglehart st.

New York City.—Paving contracts in Bronx boro have been awarded as follows: Asphalt Construction Co., $4,509; D. W. Moran, $2,315; P. J. Kana, $2,545; George J. Bailey, $4,281.

Little Rock, Ark.—Contracts for paving sections of Tenth st. were awarded to Eugene Swain & Co., of Ft. Scott, Kan., for $76,000, and to the Southern Bitulithic Co., of Nashville, Tenn., for $11,500.

Birmingham, Ala. — Paving contracts have been awarded as follows: First ave. bituminous and vitrified brick, Southern Bitulithic Co., Nashville, Tenn., $28,500; Fourteenth and Twenty-fourth sts., vitrified brick, Dunn & Lallande Bros., $21,216.

Dayton, O.—Hoglen & Gebhart secured the contract for macadamizing ¾ mi. of the Dayton and Lebanon pike in Washington twp. at 25 cts. a cu. yd. for excavation, $1.10 a cu. yd. for Knap stone, $1.60 a cu. yd. for crushed stone.

Mobile, Ala.—The contract for resurfacing Water st. from Government to St. Michaels sts., and making repairs to other streets in asphalt paving distirct No. 1, was awarded Jan. 16 to the Asphalt Paving Co. of Georgia, for $8,400.

New Orleans, La. — The contract for draining and improving the land owned in the rear of this city by the New Orleans Land Co. was awarded to the Grasser Constructing Co. A shell road will be built to Bayou St. John, a distance of 5 mis.

SEWERS.

Dallas, Tex.—The North Texas Culvert, Sewer and Construction Co. has been incorporated by D. E. Wagoner, J. A. Ewton and Rhodes S. Baker.

CONTEMPLATED WORK.

Lake Charles, La.—A sewerage system is contemplated.

Trenton, Mich.—A sewerage system is contemplated.

Lajolla, Cal.—A sewerage system is contemplated.

Newark, N. Y.—Plans for a sewerage system have been completed.

Merchantville, N. J.—Plans are being prepared for a sewerage system.

Chickasha, I. T.—This city voted to issue bonds for sewer extensions.

Matteawan, N. Y.—This city voted to construct a sewage-disposal plant.

Hammond, La. — This town contemplates the construction of a sewerage system.

Norfolk, Neb.—Bonds for $50,000 will be issued for sewer construction here.

Watertown, S. D.—A main sewer from Rice st. to the Sioux river is contemplated.

Omaha, Neb.—Plans are being prepared for new sewers to cost about $150,000.

Norwood, Pa.—Plans are being prepared for a sewerage system and macadam streets.

Jersey City, N. J.—New plans for a drainage system in Pamrapo ave. will be prepared.

Carrick, Pa.—Plans and specifications are being prepared for a complete sewerage system.

Sparks, Nev.—An engineer has been engaged to prepare plans for complete sewerage system.

Bennettsville, S. C.—This city contemplates constructing a sewerage and waterworks system.

Marianna, Ark.—Plans are being prepared for a sanitary sewer system. E. W. King, sec. drainage com.

Joliet, Ill.—Specifications will be ready about April 15 for tile sewers. H. A. Stevens, cy. engr.

Wilmette, Ill.—Plans are being prepared for a concrete sewer and bids will be asked this spring.

Stanford, Conn.—A new sewage pumping station will be constructed this year. Paul Nash, cy. engr.

Oakland, Cal.—Council voted to issue bonds for building a number of sewers. F. C. Turner, cy. engr.

Akron, O.—Cy. Engr. Payne estimates the cost of an 8-in. sewer in Huron and Poplar sts. at $1,006.45.

Knoxville, Ia.—Bids will be asked after Feb. 1 for building 2 mis. tile sewers. W. S. Bilby, mayor.

Hartford, Conn. — An ordinance has been passed for building a sewer in New Britain ave. F. L. Ford, cy. engr.

Pekin, Ill. — An ordinance has been passed to build a storm sewer in district No. 4. D. H. Jansen, cy. engr.

Cape May, N. J.—Council is considering the construction of a new sewer system. De Witt D. Barlow, cy. engr.

Redondo, Cal.—A resolution has been adopted to vote on the issue of bonds for a septic outfall sewer system.

Fitzgerald, Ga.—Plans and estimates for a sewer system will be prepared by J. B. McCrary, of Senoia.

East Palestine, O.—The question of issuing $5,000 bonds for constructing a sewerage system will be voted on Feb. 20.

Altoona, Pa. — Ordinances have been passed for constructing sewers in sundry streets. Harvey Linton, cy. engr.

Bridgeport, Conn.—The construction of a 48-in. brick sewer on Noble ave. is contemplated. Wm. W. Starr, cy. surv.

Washington, Pa.—Isaac W. Baum is chairman of a committee that has been appointed to investigate sewage-disposal plants.

West Chester, Pa.—Plans for a sewerage system have been completed and the question of issuing bonds will be voted on.

Nashua, N. H.—The construction of a trunk sewer in Burke st. is contemplated, at a cost of $150,000. E. J. Johnson, cy. engr.

Cleveland, O. T.—This city has decided to expend about $30,000 for a sewer system. Plans for the work have been accepted.

South Omaha, Neb.—An ordinance has been presented to Council providing for the issue of $250,000 bonds for constructing a sewer system.

Bristol, Pa.—Plans, surveys and estimates for a sewerage system and sewage-disposal plant will be made by Wm. H. Boardman, of Philadelphia.

Seattle, Wash.—A resolution has been adopted to construct sewers in Eastlake ave. and other connecting streets and avenues, at a cost of $97,500.

Oconomowoc, Wis.—The estimated cost of constructing a sewage-disposal plant, including septic tank and pump, is $22,000. George E. Robinson is interested.

Allentown, Pa.—Plans and specifications are being prepared for installing a house-sewerage system with sewage-disposal plant. H. F. Bascom, cy. engr.

Kansas City, Mo.—Plans will be ready Feb. 1 for the proposed large sewer to replace the O. K. Creek sewer. It will be 6,000 ft. long and will cost about $400,000.

St. Louis, Mo.—Plans have been prepared for constructing the Harlem creek sewer for the drainage of the northwestern part of this city. Estimated cost, $225,000.

Newark, N. J.—An ordinance has passed second reading providing for the construction of a system of sewers to be known as East Branch intercepting sewer, Section 2. Wm. E. Greathead, clk. bd.

Decatur, Ill. — A. B. Alexander, cy. engr., has made drawings and estimates of the cost of a large sewer to drain the northwest quarter of this city. The sewer will be 3 mis. long and will cost $113,-261.45.

Hattiesburg, Miss. — Special. — Richard C. Huston, cy. engr., says he is interested in work for which machinery and materials may be purchased, as follows: Sewer extensions, $15,000; sewage-disposal plant for Lamar county, Miss.

CONTRACTS TO BE LET.

Sioux City, Ia.—Bids are asked until Feb. 8 for constructing the farmers' ditch in Sloan. Co. audt.

Narbeth, Pa. — Bids are asked until Feb. 5 for constructing a sewer system. E. C. Hawley, clk. coun.

Emmetsburg, It.—Bids are asked until Feb. 15 for constructing an 8-in. sewer. P. H. Hand, cy. clk.

Dayton, O.—Bids are asked until Feb. 15 for constructing a storm sewer system. F. M. Turner, cy. engr.

Cincinnati, O. — Bids are asked until Feb. 5 for constructing sewers in Symes st. M. J. Keefe, clk. B. P. S.

Jefferson Barracks, Mo. — Bids are asked until Feb. 10 for constructing a 6-in. sewer. W. C. Cannon, Q. M.

Cloverdale, Cal.—Bids are asked until Feb. 27 for constructing a sewerage system. T. B. Wilson, town clk.

Montgomery, Ala.—Bids are asked until Feb. 5 for building sewers in several streets. R. S. Williams, cy. treas.

Atlanta, Ga.—Bids are asked until Feb. 5 for constructing sewers this year. Cy. Clk Campbell; R. M. Clayton, cy. engr.

Mohawk, N. Y.—Bids are asked until Feb. 16 for constructing about 5¼ mis. of pipe sewers. D. C. Ford, prest. Munic. Bd.

Ft. Assinniboine, Mont.—Bids are asked until Feb. 19 for constructing a bacterial sewage purification plant here. Capt. J. B. McDonald, Const. Q. M.

Cincinnati, O.—Sealed bids are asked until Feb. 16 for constructing a box culvert on Cincinnati ave. at North Bend, Miami twp. C. C. Richardson, co. audt.

Savannah, Ga.—Bids are asked until Feb. 6 for building an addition to the bacterial purification plant for sewage disposal at Ft. Oglethorpe. Capt. H. D. Berkeley, Q. M.

Cresco, Ia.—Sealed bids are asked until Feb. 15 for constructing 2 sewers, aggregate length 4,050 ft., 8 manholes and 2 flush tanks. W. L. Richards, chmn. sewerage com.

Montevideo, Minn.—Bids are asked until Feb. 10 for constructing ditch No. 7, consisting of 7 mis. of main ditch and 2,700 lin. ft. of laterals. F. J. Rubertus, co. audt.

New York City.—Bids are asked until Feb. 8 for constructing a storm relief tunnel sewer from the Webster ave. sewer, near Wendover ave., in the Mill Brook watershed, sewerage district No. 33, to Harlem river, north of High Bridge. Bids are asked until Feb. 8 for constructing sewers in various streets in Bronx boro. Louis F. Haffen, prest. boro.

CONTRACTS AWARDED.

Anamosa, La.—The contract for extending the Main st. sewer was awarded to E. W. Harrison.

Redding, Cal.—The contract for constructing a sewer in Chestnut st. was awarded to Frank Thompson, for $2,100.

Trenton, N. J.—The contract for constructing drains in two streets was awarded to Antonio De Lucio, for $21,072.

Tacoma, Wash.—Carlson & Swanson secured the contract for constructing a sewer in the 4th ward, district No. 152, for $16,677.75.

Kelso, Wash.—The Little Falls Fire Clay Co., of Tacoma. Wash., was awarded the contract for furnishing pipe for the sewer work here, for $1,865, and Secor Bros., of this city, the contract for construction work, for $1,533.

WATER WORKS.

Newark, O.—Harry H. Baird, of Pataskala, was appointed receiver January 4 of the Newark Water Co.

Chester, Pa.—The La Grange Water Co. has been incorporated to build and operate water plants and pipe lines.

CONTEMPLATED WORK.

Jackson, La.—This city will erect a municipal water-works system.

Chickasha, I. T.—This city voted to issue bonds for water-works extensions.

Winona, Minn.—The water-meter system of this city will probably be extended.

Wellesley, Mass.—This town voted to expend $10,000 for the extension of the water system.

Terre Haute, Ind. — The West Terre Haute Water-works Co. has decided to build a municipal water-works plant.

Duluth, Minn.—This city voted February 6 on an additional bond issue of $200,000 for water and lights.

Centralia, Wash.—This city is considering the question of installing a municipal water-works system.

Trinidad, Col.—Bids will be asked about March 1 for constructing a water-works system. C. H. Nichols, mayor.

Manchester, Va.—The committee has reported that a filtration plant should be installed. C. C. Jones, chmn. com.

Little Rock, Ark.—Special.—Elmer L. Gochenour desires to purchase machinery for water-works and electric-light plants.

Walla Walla, Wash.—City Council is considering the employment of an engineer to construct the proposed gravity water-works system.

Tonawanda, N. Y.—Estimates will be made of the cost of constructing a 20-inch c. i. water main in Thompson st. A. P. Smith, cy. engr.

Garrettsville, O.—Council has employed L. E. Chapin, of Canton, as engineer in charge of the construction of the water-works system.

Houston, Tex.—The stockholders of the Hyde Park Improvement Co. decided January 10 to build a water-works system to supply that addition.

Lawrenceville, Ind.—A company of local

capitalists has asked for a franchise to operate a water-works system here. W. H. O'Brien interested.

Billings, Mont.—The present water franchise will expire during 1906 and the City Council is considering the matter of installing a municipal plant.

Cambridge, Mass.—This city will construct a section of pipe line between Irving st., Watertown, and Newton st., Waltham. C. H. Thurston, mayor.

Waterloo, Ia.—The Waterloo Water Co. is reported as needing a new deep-well pump, dynamos and motor, and a clear-water basin. J. P. Berry, supt.

Cumberland, Me.—The Foreside Water Co. has been incorporated and will supply the towns of Falmouth and Cumberland with water. John M. Brown, prest.

Wheeling, W. Va.—The Water Board, in its annual report, recommends the purchase of a pump and the construction of a larger reservoir. Wilson Hoge, cy. engr.

Atlanta, Ga.—The Water-works Commission has asked for $30,000 in order to commence work on a duplicate water main from the river to the reservoir. R. M. Clayton, cy. engr.

The question of issuing bonds for constructing water works is up at Carrington, N. D.; Rockport, Ga.; Vernon Center, Minn.; Weston, Neb.; Roff, I. T., and Eugene, Ore.

Sharon, Pa.—Plans have been prepared for constructing a steel sedimentation tank, a concrete pump well, an intake chamber and a pump, by the Sharon Water Co. P. J. Purcell, supt.

Tacoma, Wash.—Frank L. Davis, cy. engr., estimates the cost of securing the proposed gravity water system by tapping Greenwater river at $1,635,000. Wm. Welsh, comr. pub. wks.

Buffalo, N. Y.—Special.—Francis G. Ward, comr. pub. wks., has recommended that he be authorized to ask for plans for the proper mechanical filtration of the water supply of this city.

Porterville, Cal.—The question of issuing bonds for $50,000 for acquiring the water-works system now owned and operated by the Porterville Water-works Co. will be voted on February 12. Robt. Horbach, cy. clk.

Knoxville, Tenn.—The ordinance authorizing this city to issue $750,000 water-works bonds for constructing municipal water works passed third and final reading January 19. Mayor Gass.

Hattiesburg, Miss. — Special. — Richard C. Huston, cy. engr., advises us that he is interested in water-works extensions here to cost $35,000; water-works system at Poplarsville, Miss.; small water-works and sewage-disposal systems for Lamar county.

The construction of water-works systems is contemplated at the following places: Bennettsville, S. C.; Preston, Utah; Troy, Idaho; Carencro, La.; Urbana, Va.; Kulm, N. D.; Pine City, Minn.; La Junta, Colo.; Patchogue, N. Y.; Belle Plaine, Ia.; Athens, Mich.

Lewistown, Mont.—Surveys and estimates for the construction of gravity pipe line from Big Spring to the distributing reservoir at this city, 4½ mis., will be made by O. F. Wasmansdorff, acting cy. engr. The specifications will be ready about March 1.

Brooklyn, N. Y.—An appropriation of $1,290,000 has been asked for the construction of a 6-ft. steel conduit from Ridgewood station to Valley Stream, a distance of 8 mis., which will increase the water supply from this boro 16,000,000 gals. a day. Wm. C. Cozier, deputy comr. water sup.

CONTRACTS TO BE LET.

Gunnison, Colo.—Bids are asked until Feb. 14 for constructing a water-works system. F. W. Harper, town clk.

Brandon, Minn.—Bids are asked until Feb. 6 for constructing a water-works system. J. C. Metcalf, recorder.

Greeley, Colo.—Bids are asked until Feb. 6. for constructing a gravity water system. M. P. Henderson, cy. clk.

Shreveport, La.—Bids are asked until Feb. 13 for erecting a steel tower for fire alarm bell. C. G. Rives, compt.

Watonga, Ok.—Bids are asked until Feb. 9 for constructing improvements to the water-works system. G. E. Moore, cy. clk.

Jackson, Mo.—Bids are asked until Feb. 19 for constructing a water-works and electric light system. Edward O. Hays, mayor.

Atlanta, Ga.—Bids are asked until Feb. 3 for extending the water distribution system at Fort Fremont. Sam R. Jones, ch. Q. M.

Rock Island, Ill.—Sealed bids are asked until Feb. 12 for erecting an addition to the water-works building. H. C. Schaffer, cy. clk.

Rapid City, S. D.—Bids are asked until Feb. 6 for constructing a water plant here. F. E. Leupp, comr. Indian Affairs, Washington, D. C.

Riverside Park, Va.—Bids are asked until Feb. 16 for the extension of the water distribution system at Ft. Washington. Lieut. W. R. Vance, Q. M.

New York City.—Bids are asked until Feb. 5 for making test borings in the channel and along shores of Hudson river, near Hamburg. Bd. water supply comrs.

Cochran, Ga.—Bids are asked until Feb. 6 for water tower, fire pump, boiler, generator and engine for water and light plant. W. B. Denham, cy. clk.

Lima, O.—Sealed bids are asked until Feb. 24 for installing a power plant and connecting same with two 18-in. double suction centrifugal pumps. B. P. S.

Jacksonville, Fla.—Bids are asked until Feb. 5 for furnishing 2 surface condensers with separate circulating and vacuum pumps. R. N. Ellis, supt. w.w.

San Francisco, Cal.—Bids are asked until Feb. 6 for constructing a reinforced concrete reservoir at Ft. Miley, Cal. Col. W. S. Patten, asst. Q. M. Genl.

Rahway, N. J.—Bids are asked until Feb. 7 for additions and improvements to the water-works system, consisting of a standpipe and filter plant. Bd. water comrs.

Los Angeles, Cal.—Bids are asked until Feb. 19 for the sale of a franchise to lay and operate a system of water pipes in several streets. C. G. Keyes, co. clk.

DeQueen, Ark.—Bids are asked until Feb. 15 for the purchase of c. i. water pipe, valves, pumps and boilers necessary for constructing a water-works system. L. A. Pearre.

Cincinnati, O.—Sealed bids are asked until Feb. 23 for constructing electric generating machinery for the Eastern Pumping station, near the village of California. Aug. Herrmann, prest., bd. w.w. trustees.

Ft. Hancock, N. J.—Bids are asked until Feb. 10 for constructing an addition to the pumphouse, a 40,000-gal. concrete reservoir, and installing an air compressor and air lifts for wells. Lieut. Wm. Patterson, Q. M.

Indianapolis, Ind.—Sealed bids are asked until March 15 for the construction

of a canal in Southern Oregon, in accordance with the plans and specifications of J. S. Howard, engineer. The excavation is to be 14 feet at top, 8 ft. at bottom and 55 mis. in length, this being the first section. Address The Gold Hill Canal Co., 825 Law Bldg., Indianapolis.

CONTRACTS AWARDED.

Martinsville, Ill.—A franchise has been granted to Leach & Co. for installing a water-works system here.

Edgemont, S. D.—A franchise has been granted Samuel S. Thompson and associates for 20 yrs. for constructing and operating a water-works plant.

New York City.—The contract for installing high pressure salt water mains in this city was awarded to the Continental Asphalt Paving Co., for about $3,000,000.

Manila, P. I.—The contract for constructing a new gravity water-works system here was awarded, in equal parts, to Matson, Lord, Belter & Co., of San Francisco, for $1,040,729, and to the Atlantic, Gulf & Pacific Co., of New York and San Francisco, for $1,071,990.

Marksville, La.—The water-works contract for this city was awarded as follows: Pipe, A. B. Sanders, of Shreveport, La., and U. S. Cast Iron Pipe & Foundry Co., of Chattanooga; pumps, Platt Iron Works, Dayton, O.; tower and tank, Chicago Bridge & Iron Co.; hydrants, valves and valve boxes, Fairbanks Co., New Orleans.

BRIDGES.

Oakdale, Ill.—A new bridge across Embarass river is contemplated.

Hahnaman, Ill.—A new steel bridge across Winnebago river here is contemplated.

Chandler, Ok.—Bids are asked until Feb. 3 for building a bridge here. Co. clk.

LaPorte, Ind.—Bids are asked until Feb. 6 for building 6 iron bridges. Co. comrs.

Yankton, S. D.—Bids are asked until Feb. 6 for building county bridges. Ralph Case, co. audt.

Delaware, O.—Bids are asked until Feb. 12 for building a bridge across Delaware Run. F. D. King, co. clk.

Greensburg, Ind.—Plans are being made for 4 bridges to be built in this county. Frank E. Ryan, co. audt.

Bay City, Mich.—Supt. O'Keefe, of the bd. pub. wks., will ask for new bids for a new bridge at Military st.

Custer, S. D.—Bids are asked until March 31 for constructing a bridge across French creek. W. A. Nevins, co. audt.

Wayne, Neb.—Bids are asked until Feb. 20 for constructing all bridges during 1906. Chas. W. Reynolds, co. clk.

Cincinnati, O.—Plans for the reconstruction of the Liberty st. viaduct have been submitted by cy. engr. Dannenhower.

Colfax, Wash.—Bids are asked until Feb. 7 for building a new bridge across Union Flat creek, near Colton. H. H. Wheeler, co. audt.

Camden, N. J.—Plans have been completed for a bascule trolley and highway bridge at Federal st. J. J. Albertson, engr., Magnolia, N. J.

Atlanta, Ga.—Bids are asked until Feb. 19 for erecting a viaduct across the tracks of the Georgia Railway Co. R. M. Clayton, cy. engr.

Carthage, Tenn.—Bids will probably be received in Feb. for constructing a bridge over Cumberland river. J. W. Williams and F. C. Stratton interested.

Wilmington, Del.—The park and water commissions have practically accepted the plans and selected the site for the proposed new bridge at Van Buren st.

Philadelphia, Pa.—Bids are asked until Feb. 14 for constructing a large number of bridges, including plate girder, stone arch and reinforced concrete bridges. Geo. S. Webster, ch. engr. & sur. pub. wks.

STREET LIGHTING.

Farmington, N. Mex.—A new lighting system is to be erected here.

St. John, N. B.—City council has decided to build a municipal lighting plant.

Brookport, Ill.—An electric light and water plant is contemplated by council.

Westboro, Mass.—A municipal electric light plant is contemplated by the selectmen.

Cedar City, Utah.—The installation of an electric light and power plant is proposed.

Monon, Ind.—A. A. Wallace has asked for a franchise for an electric light plant here.

Boulder, Mont.—An electric light plant will be constructed here. Edw. Kennedy, Basin, Mont., interested.

Osawatomie, Kas.—Bids are asked until April 1 for constructing an electric light plant. W. H. Murphy, supt.

Youngstown, O.—City council took preliminary steps, Jan. 23, towards securing a municipal lighting plant.

Rockport Ga.—This city voted to issue bonds for the construction of electric light and power plants.

Jackson, Mo.—Bids are asked until Feb. 19 for constructing an electric light plant. Edward O. Hays, mayor.

Columbus, O.—The Licking Light & Power Co. contemplates building a new power plant. Col. M. M. Gillett, prest.

Lima, O.—Bids are asked until Feb. 24 for installing a power plant for pumping purposes. J. K. Brice, cy. engr.

Gunnison, Colo.—Bids are asked until Feb. 14 for constructing an electric light plant. T. J. Thompson, mayor.

Watonga, Ok.—Bids are asked until Feb. 9 for constructing an electric light plant. G. E. Moore, cy. clk.

Afton, Ia.—Bids are asked until Feb. 12 for constructing an electric street lighting plant. E. A. Lee, chmn. com.

Letts, Ia.—Special.—Elmer L. Gochanour desires to purchase machinery for electric light and water-works plants.

South Orange, N. J.—This village has decided to take steps toward establishing a municipal electric light plant.

Orange, N. J.—Bids will be received March 5, instead of Feb. 5, for lighting this city for 3 yrs. Com. on st. lgts.

Marion, Ind.—Plans for the new municipal lighting plant here are being prepared by the Diesel Engine Co., of Indianapolis.

Parry Sound, Ont.—Council will employ an engineer to prepare plans and specifications for improving the electric light plant.

Greenwich, N. Y.—Bids are asked until Feb. 7 for lighting the streets; also for erecting 2 engine houses. S. J. Tefft, vil. clk.

Delaware City, Del.—The contract for lighting Ft. Dupont with electricity has been awarded to the Delaware Improvement Co., of New Castle.

St. Cloud, Minn.—A. G. Whitney is having plans prepared for the proposed gas

plant, and they will be ready for the contractors by Feb. 10.

Dushore, Pa.—Messrs. Carroll and Obert have been appointed a committee to investigate the matter of securing an electric light plant for this city.

Peoria, Ill.—The citizens of East Peoria are considering the advisability of establishing a municipal electric lighting plant. Geo. Walmsley, prest. vil.

Grand Island, Neb.—The question of issuing $35,000 bonds for constructing a municipal lighting plant will be voted on March 6. Edward Hooper, cy. clk.

Oconto, Wis.—Bids are asked until Feb. 6 for furnishing this city with 50, more or less, arc electric lights, for 3 yrs. Jos. Pacquette, chmn. elec. lgt. com.

Kirkwood, Mo.—The question of selling the lighting plant to the General Service & Improvement Co., and to light the city by contract, will be voted on Feb. 17.

Oil City, Pa.—Bids are asked until Feb. 20 for lighting city streets, buildings, etc., with electricity for 5 and 10 yrs. A. M. Breckinridge, clk. comrs. water & lighting.

Pinegrove, Pa.—The town council has decided to submit to vote the question of increasing the town's indebtedness from $21,000 to $25,000 for the purpose of erecting an electric light plant.

Winnipeg, Man.—Bids are asked until Feb. 12 for furnishing 100 to 200 series alt. arc lamps, 100 to 200 absolute cutoffs, and 2 to 4 constant current transformers; also, 2 500-hp. electric generators. C. J. Brown, cy. clk.

Centerville, Ind.—John Clark, Nimrod Parrott, H. H. Peelle, T. G. Dunbar and Harry Anderson have been appointed a committee to investigate electric lights in other cities. This town decided, Jan. 19, to construct a plant.

Hattiesburg, Miss.—Bids are asked until Feb. 8 for 50,000 cu. ft. single lift gas holder, 2 benches of sixes, exhauster, extractor, condenser, scrubber, purifier, meter, boiler, heater, compressors and buildings. H. A. Camp, prest. Hatiesburg Gas. Co.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Blomington, Ill.—City council voted to establish a garbage crematory, at a cost of $14,000.

Council Bluffs, Ia.—Bids will be received April 2 for collecting garbage for 1 yr. Dr. Mat. A. Tinley, health officer.

Superior, Wis.—Bids will be received in May for collecting city garbage, on 1 yr. contract. J. A. Rene, health officer.

Green Bay, Wis.—Council will consider a proposition for the establishment and operation of a city garbage plant. W. W. Read, cy. engr.

Milwaukee, Wis.—Council has adopted a resolution, according to press reports, authorizing the city engineer to prepare plans for a garbage crematory of 50 tons daily capacity.

New York City.—Bids are asked until Feb. 6 for constructing a ventilating monitor for rubbish incinerator and an extension of the incinerator. M. Gibson, deputy & acting comr. st. cleaning.

Pretoria, Transvaal, S. A.—Bids are asked until March 15 for supplying and erecting a refuse destructor capable of treating 60 tons daily. Address Mosenthal, Sons & Co., 72 Besinghall st., E. C., London, Eng.

FIRE APPARATUS.

Norfolk, Va.—Bids are asked until Feb. 10 for a fire alarm system at U. S. Navy Yard.

Shreveport, La.—Bids are asked until Feb. 13 for erecting a structural steel tower for the fire alarm bell. C. G. Rives, compt.

Pensacola, Fla.—Bids are asked until Feb. 6 for furnishing 1,500 ft. rubber fire hose. H. T. B. Harris, Paym-Genl., Washington, D. C.

Orange, N. J.—In his nineteenth annual report, Jas. W. Hodgkinson, fire chief, recomends the purchase of more fire hose, a new 2nd size steamer, etc.

Kendallville, Ind. — Special. — James Graves, mayor, says this city contemplates the purchase of a fire alarm system, hose wagon, hose, nozzles, extinguishers, ladders and apparatus for fighting fire.

TOO LATE FOR CLASSIFICATION

Colquitt, Ga.—Bids will be received about Feb. 1 to Feb. 15 for water-works.

Clinton, Ia.—Bids are asked until Feb. 7 for macadamizing certain streets. Co. audt.

Crookston, Minn.—Bids are asked until Feb. 27 for a hose wagon and chemical engine. Cy. clk.

Effingham, Ill.—Bids are asked until March 1 for paving Jefferson st. with brick. F. E. Hill, cy. clk.

Lexington, N. C.—Bids are asked until Feb. 22 for constructing a sewerage system. John H. Moyer, mayor.

Harrisburg, Pa.—Bids are asked until Feb. 2 for building sewers in 2 streets. W. H. Lynch, highway comr.

Montgomery, Ala.—Bids are asked until Feb. 5 for building sewers in 7 streets. R. S. Williams, cy. treas.

East Grand Forks, Minn.—Sealed bids are asked until Feb. 13 for electric light machinery. Jas. Gorman, cy. recorder.

Manistee, Mich.—Bids are asked until March 1 for 15,000 sq. yds. of brick, bitulithic or macadam paving on River st.

Boise, Idaho.—Bids are asked until Feb. 8 for paving with asphalt, vitrified brick and bitulithic. J. A. Beal, cy. clk.

Sharon, Conn.—Bids are asked until Feb. 16 for constructing a concrete septic tank and gate chamber, 2 sand filter beds, 1 sludge bed, and main and lateral sewers. Willard Baker, prest. Sharon drainage co.

Jacksonville, Fla.—Bids are asked until March 5 for furnishing and laying c. i. and terra cotta sewers, Y branches and manholes, brick drains, circular brick drains and D. S. terra cotta drains, with manholes. Trustee w.w.

Minneapolis, Minn.—The city engr. will ask for bids for resurfacing 110,000 sq. yds. downtown streets with asphalt. Bids will be also asked for furnishing Portland cement, crushed stone, cedar blocks, and sand for the coming year.

Lawrence, Ind.—Bids will be received until Feb. 24 for constructing a sewer purification plant, sewer system, sinking wells, boiler and pump house, water distributing plant, reservoir, boilers, pumps, etc. Capt. B. F. Cheatham, Const. Q. M.

Marion, Mass.—Bids are asked until Feb. 13 for trenching and laying 17,500 ft. of vitrified pipe sewer, building 2 small covered concrete reservoirs, building intermittent sand filter, furnishing and erecting 22 sets of pumping machinery, etc. Selectmen.